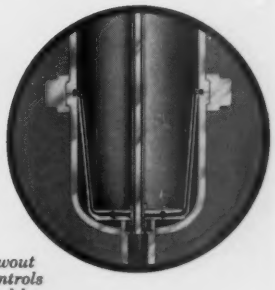
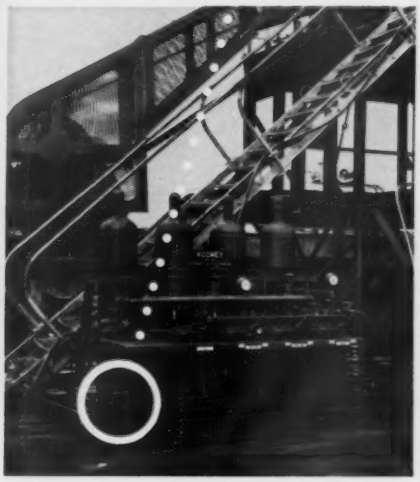
Another new development using

B.F.Goodrich Chemical *raw materials*



Koomey blowout preventer controls manufactured by Stewart & Stevenson Distributing Company, Houston, use bladders made of Hycar by Oteco Equipment Company, Houston. B.F.Goodrich Chemical Company supplies the Hycar nitrile rubber.



500,000 cycles prove toughness of Hycar accumulator bladder

Before the bladder made of Hycar nitrile rubber shown above was approved for use in accumulators like the one in the background, it was tested for more than half a million cycles under highest pressures—with no signs of failure.

The toughness and resilience that even 500,000 cycles can't affect is only one advantage provided by Hycar. Its unusual ability to resist deterioration provides longer, surer, safer operation for this and other oil field equipment. Hycar resists chemicals, oils and solvents that destroy ordinary rubber.

Here's another example of why it pays to specify Hycar everywhere in oil fields. For more information, write Dept. MC-3, B.F.Goodrich Chemical Company, 3135 Euclid Avenue, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

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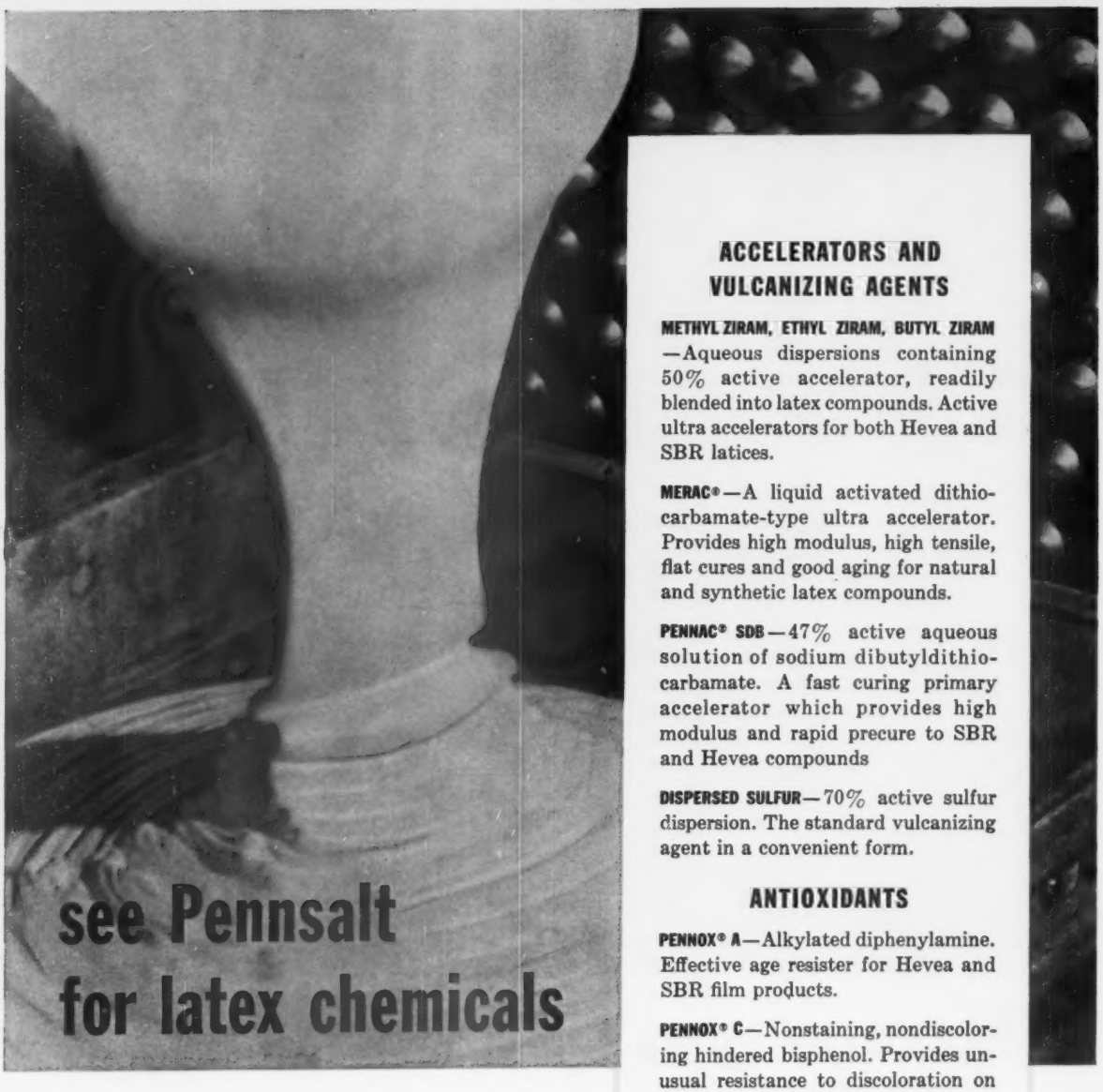

see Pennsalt for latex chemicals

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Rubber Age

COVERING THE MANUFACTURE OF RUBBER AND RUBBERLIKE PLASTICS PRODUCTS

MARCH, 1961 VOL. 88, NO. 6

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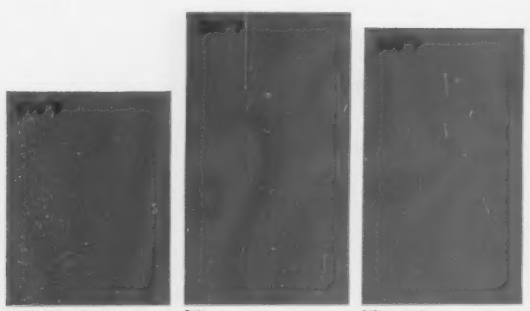

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Highlights Sidelights *of the News...*

March, 1961

ASTM Committee D-11 on Rubber and Rubberlike Materials and seventeen of its subcommittees met on February 1 to 3 at the Netherland Hilton Hotel in Cincinnati, Ohio . . . A feature of the meeting was the presentation of a paper by John Mandel (Bureau of Standards) on "Interlaboratory Studies of Test Methods" . . . The next meeting of Committee D-11 will be held on June 27 to 30 in Atlantic City, N. J. (page 999).

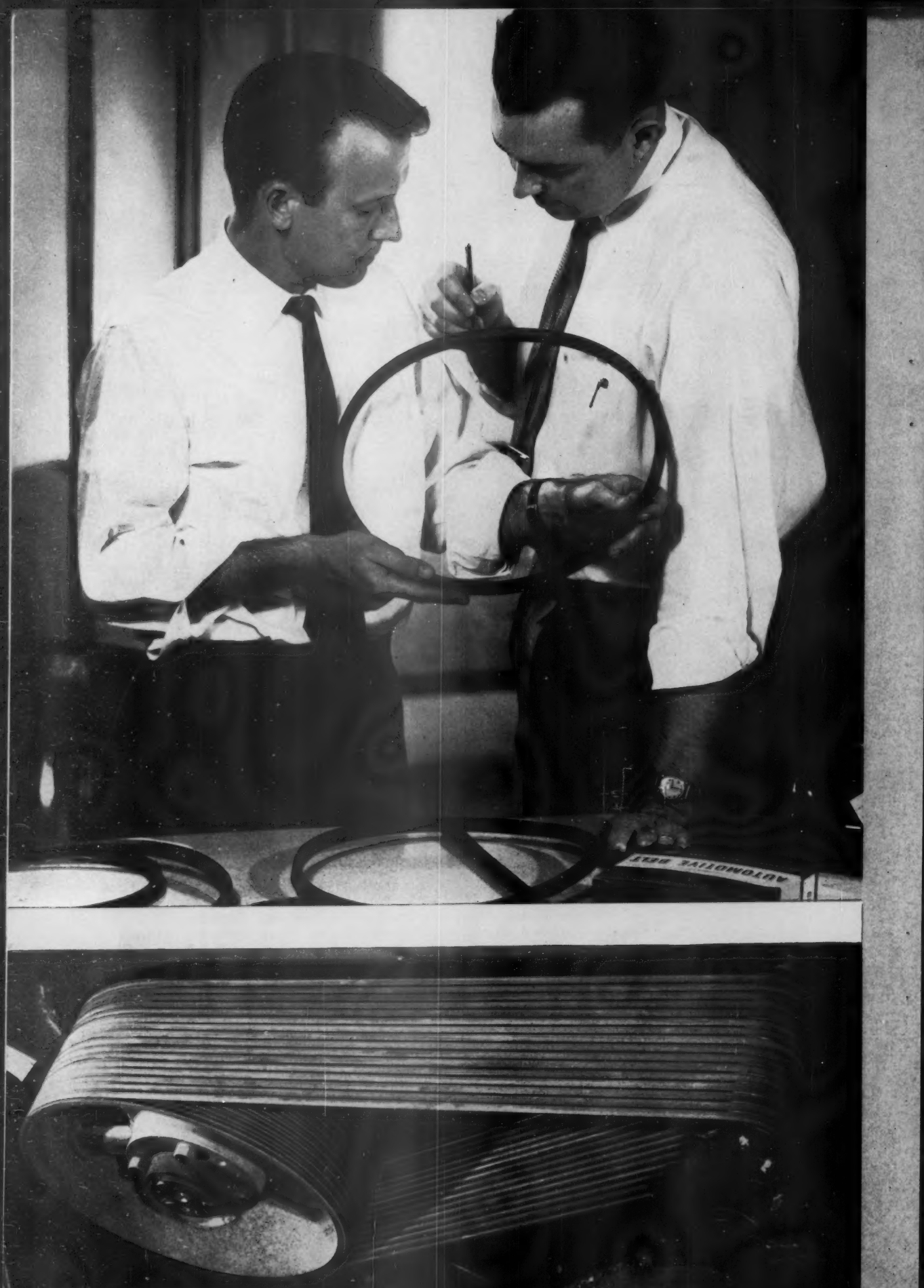
DuPont has announced the development of a new ethylene-propylene synthetic rubber which can be sulfur-cured by conventional techniques . . . Laboratory tests indicate that the polymer is well-suited for general purpose use, and it appears to have excellent resistance to ozone, weather and abrasion . . . The company advises that the new elastomer processes well and can be compounded in a wide range of stable colors (page 1005).

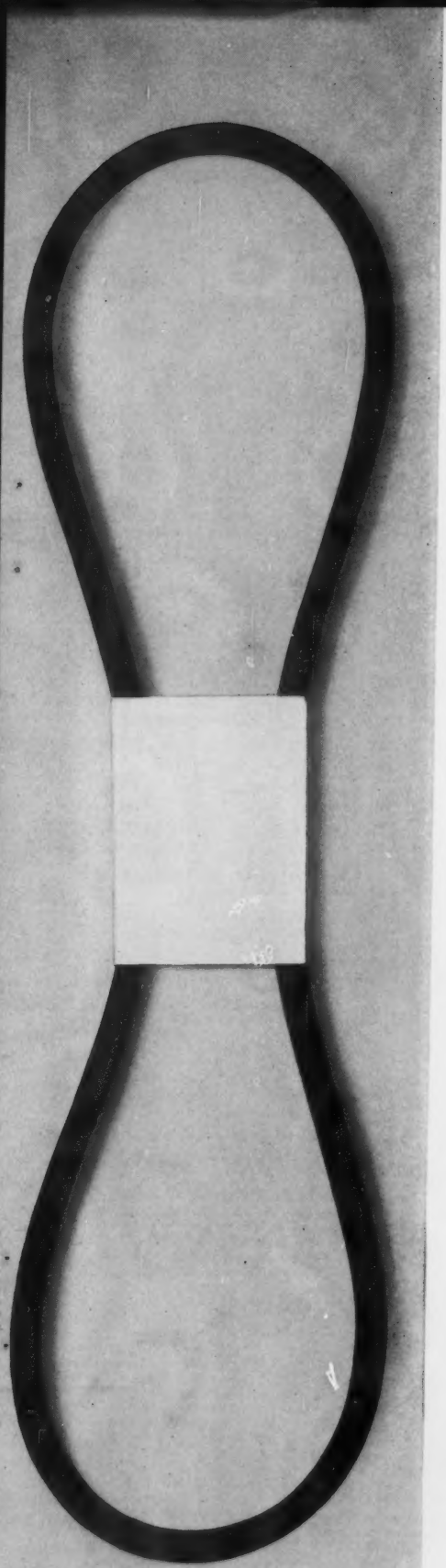
A suit charging conflict of interest has been filed against the Seiberling Rubber Co. and thirteen other defendants by Edward Lamb, director and largest single shareholder in the company . . . Mr. Lamb charges that Seiberling purchased $400,000 worth of truck tire building machinery from the National Rubber Machinery Co. at excessive prices without competitive bids (page 1006).

Current reports state that four expropriated American-owned tire plants in Cuba have shut down due to acute shortages of carbon black . . . Three of the plants are said to have been closed since early this year, and the fourth facility closed during the latter part of February . . . It is reported that Cuban authorities failed in their efforts to secure quantities of carbon black from the United States and Canada . . . Supplies were also sought behind the Iron Curtain, without success (page 1012).

The Natural Rubber Bureau advises that an entire section within the Natural Rubber Producer's Research Association has been organized to exclusively handle technical service problems . . . The Bureau has also announced that another natural rubber technical service representative would be added to its staff in the United States (page 1025).

Meeting reports covered in this issue include the January 10th meeting of the Ontario Rubber Group at which rubber-to-metal bonding was discussed (page 1004) . . . the January 27th symposium of the Akron Rubber Group on radiation and rubber (page 1007) . . . and the February 9th meeting of the Fort Wayne Rubber & Plastics Group which featured a paper on ABS plastic properties (page 1023).





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coming events

March 21-23. American Physical Society, High Polymer Physics Division, 21st Annual Meeting, Monterey, Calif.

March 21-30. American Chemical Society, 139th National Meeting, St. Louis, Mo.

March 23. Quebec Rubber & Plastics Group, Technical Meeting, Queen's Hotel, Montreal, Quebec, Canada.

March 23. Southern Ohio Rubber Group, Spring Technical Meeting, Engineers Club, Dayton, Ohio.

March 24. New York Rubber Group, Spring Meeting, Henry Hudson Hotel, New York, N. Y.

April 4. Los Angeles Rubber Group, Technical Meeting, Hotel Biltmore, Los Angeles, Calif.

April 6. Akron Rubber Group, Spring Meeting, Sheraton Hotel, Akron, Ohio.

April 6. Rhode Island Rubber Club, Spring Meeting, Pawtucket Country Club, Pawtucket, R. I.

April 11. Ontario Rubber Group, Cloverleaf Hotel, Toronto, Ontario, Canada.

April 13. Fort Wayne Rubber & Plastics Group, Technical Meeting, Van Orman Hotel, Fort Wayne, Indiana.

April 19-21. Division of Rubber Chemistry, American Chemical Society, Spring Meeting, Brown Hotel, Louisville, Ky.

April 19. Quebec Rubber & Plastics Group, Technical Meeting, Queen's Hotel, Montreal, Quebec, Canada.

April 19. Washington Rubber Group, Ladies Night, Washington, D. C.

April 21. Detroit Rubber & Plastics Group, Spring Meeting, Wolverine Hotel, Detroit, Michigan.

April 27-28. Electric Wire & Cable Section, Wire Association, Regional Meeting, Sheraton-Atlantic Hotel, New York, N. Y.

April 28. Chicago Rubber Group, Technical Meeting, Furniture Club, Chicago, Ill.

April 28. Philadelphia Rubber Group, Technical Meeting, Poor Richard Club, Philadelphia, Penna.

May 2. Los Angeles Rubber Group, Technical Meeting, Biltmore Hotel, Los Angeles, Calif.

May 12. Buffalo Rubber Group-Ontario Rubber Group, Joint Meeting, Sheraton Brock Hotel, Niagara Falls, Ontario, Canada.

May 16. Elastomer & Plastics Group, Northeastern Section, American Chemical Society, Annual Short Talks Meeting, Morse Auditorium, Boston, Mass.

May 17. Washington Rubber Group, Annual Meeting, Pepco Auditorium, Washington, D. C.

May 19. Connecticut Rubber Group, Technical Meeting.

June 1. New York Rubber Group, Summer Outing, Old Cedar Mill Grove, Union, N. J.

June 2. Quebec Rubber & Plastics Group, Golf Outing, St. Hyacinthe, Quebec, Canada.

June 3. Southern Ohio Rubber Group, Summer Outing.

June 8. Rhode Island Rubber Club, Summer Outing, Pawtucket Country Club, Pawtucket, R. I.

June 9. Fort Wayne Rubber & Plastics Group, Summer Outing, Tippecanoe Lake Country Club, Ft. Wayne, Ind.

June 9-11. Los Angeles Rubber Group, Summer Outing, Stardust Hotel, Las Vegas, Nev.

June 13. Buffalo Rubber Group, Summer Outing, Lancaster Country Club, Buffalo, N. Y.

June 16. Akron Rubber Group, Summer Outing, Firestone Country Club, Akron, Ohio.

June 16. Boston Rubber Group, Summer Outing, Andover Country Club, Andover, Mass.

June 23. Detroit Rubber & Plastics Group, Summer Meeting, Western Country Club, Detroit, Mich.

June 23-24. Southern Rubber Group, Buena Vista Hotel, Biloxi, Miss.

June 25-30. ASTM Annual Meeting, Chalfonte-Hall, Atlantic City, N. J.

June 27-30. Committee D-11 on Rubber and Rubber-Like Materials, ASTM, Annual Meeting, Chalfonte-Haddon Hall, Atlantic City, N. J.

July 3-7. Gordon Research Conferences, Polymers, Colby Junior College, New London, N. H.

July 17-21. Gordon Research Conferences, Elastomers, Colby Junior College, New London, N. H.

August 4. Rubber Chemistry Division, Chemical Institute of Canada, Technical Meeting, Queen Elizabeth Hotel, Montreal, Quebec, Canada.

August 10. New York Rubber Group, Golf Outing, Scotch Plains and Echo Lake Country Clubs, Scotch Plains and Westfield, N. J.

Aug. 18. Philadelphia Rubber Group, Golf Outing, Manufacturers Country Club, Oreland, Penna.

Aug. 28-Sept. 1. Gordon Research Conferences, Adhesion, New Hampton School, New Hampton, N. H.

Sept. 3-8. American Chemical Society, 140th National Meeting, Chicago, Ill.

Sept. 5. Los Angeles Rubber Group, Technical Meeting, Biltmore Hotel, Los Angeles, Calif.

Sept. 5-8. Division of Rubber Chemistry, American Chemical Society, Sherman Hotel, Chicago, Ill.

Sept. 9. Connecticut Rubber Group, Annual Outing.

Sept. 21. Fort Wayne Rubber & Plastics Group, Van Orman Hotel, Fort Wayne, Ind.

Sept. 28. Southern Ohio Rubber Group, Fall Technical Meeting.

Oct. 3. Los Angeles Rubber Group, Technical Meeting, Biltmore Hotel, Los Angeles, Calif.

Oct. 5. Detroit Rubber & Plastics Group, Fall Meeting, Wolverine Hotel, Detroit, Mich.

Oct. 10. Buffalo Rubber Group, Fall Meeting, Hotel Westbrook, Buffalo, N. Y.

Oct. 13. Boston Rubber Group, Fall Meeting, Somerset Hotel, Boston, Mass.

Oct. 20. Akron Rubber Group, Technical Meeting, Sheraton Hotel, Akron, Ohio.

Oct. 20. Joint Meeting of New York, Connecticut and Philadelphia Rubber Groups, Henry Hudson Hotel, New York, N. Y.

Nov. 2. Rhode Island Rubber Club, Fall Meeting, Pawtucket Country Club, Pawtucket, R. I.

Nov. 3. Philadelphia Rubber Group, Fall Dance, Manufacturers Country Club, Oreland, Penna.

Nov. 17. Connecticut Rubber Group, Technical Meeting.

Nov. 26-Dec. 1. American Society of Mechanical Engineers, Winter Annual Meeting, Statler Hilton Hotel, New York, N. Y.

Dec. 1. Tenth Annual Wire & Cable Symposium, Berkeley-Carteret Hotel, Asbury Park, N. J.

Dec. 7. Fort Wayne Rubber & Plastics Group, Van Orman Hotel, Fort Wayne, Ind.

Dec. 9. Southern Ohio Rubber Group, Christmas Party.

Dec. 12. Buffalo Rubber Group, Christmas Party, Buffalo Trap and Field Club, Buffalo, N. Y.

Dec. 15. Boston Rubber Group, Christmas Party, Somerset Hotel, Boston, Mass.

Dec. 15. New York Rubber Group, Christmas Party, Henry Hudson Hotel, New York, N. Y.

April 24-27, 1962. Division of Rubber Chemistry, American Chemical Society, Hotel Statler, Boston, Mass.

Oct. 16-19, 1962. Division of Rubber Chemistry, American Chemical Society, Hotel Cleveland, Cleveland, Ohio.

May 7-10, 1963. Division of Rubber Chemistry, American Chemical Society, Royal York Hotel, Toronto, Ontario, Canada.

Sept. 10-13, 1963. Division of Rubber Chemistry, American Chemical Society, Hotel Commodore, New York, N. Y.

April 28-May 1, 1964. Division of Rubber Chemistry, American Chemical Society, Sheraton-Cadillac Hotel, Detroit, Mich.

Sept. 1-4, 1964. Division of Rubber Chemistry, American Chemical Society, Sherman Hotel, Chicago, Ill.

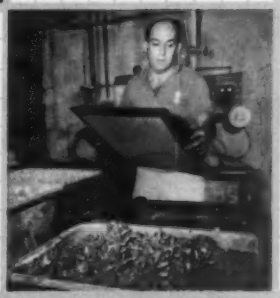
Spring 1965. Division of Rubber Chemistry, American Chemical Society, Miami Beach, Fla.

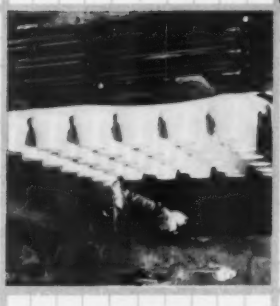
Oct. 19-22, 1965. Division of Rubber Chemistry, American Chemical Society Bellevue-Stratford Hotel, Philadelphia, Penna.

May 3-6, 1966. Division of Rubber Chemistry, American Chemical Society, Fairmount Hotel, San Francisco, Calif.

May 2-5, 1967. Division of Rubber Chemistry, American Chemical Society, Queen Elizabeth Hotel, Montreal, Quebec, Canada.

Sept. 12-15, 1967. Division of Rubber Chemistry, American Chemical Society, Sherman Hotel, Chicago, Ill.





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From the outset, customers welcomed Assured Processability as an answer to a long-standing problem. Now they can tell *in advance* how a particular type of PLIOFLEX will perform every time. *And only the Assured Processability of* PLIOFLEX *provides a realistic indication of how a styrene/butadiene rubber will perform under plant conditions.*

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Here's how customers benefit

More and more customers are reaping big benefits from Assured Processability!

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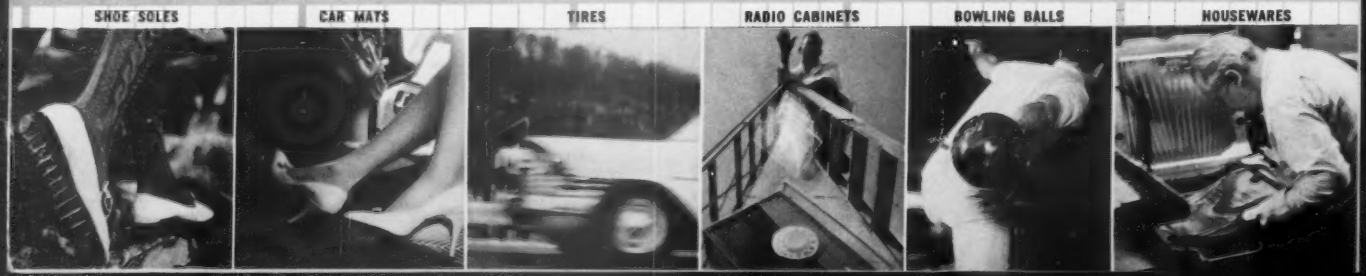
Assured Processability pays off in all these applications...and many more!



helps level out your quality control line

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A third discovered that PLIOFLEX 1713 could be used in combination with other rubbers to provide the right color characteristics and save several cents per pound!

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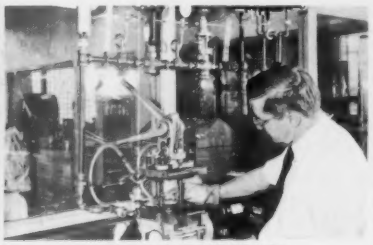

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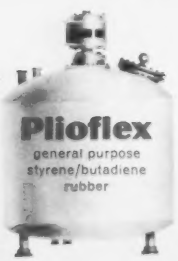

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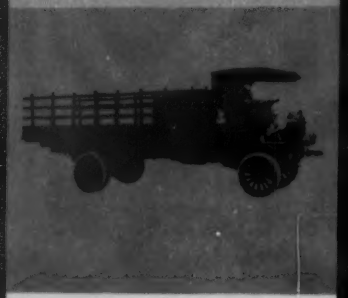

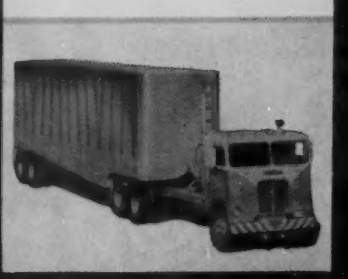

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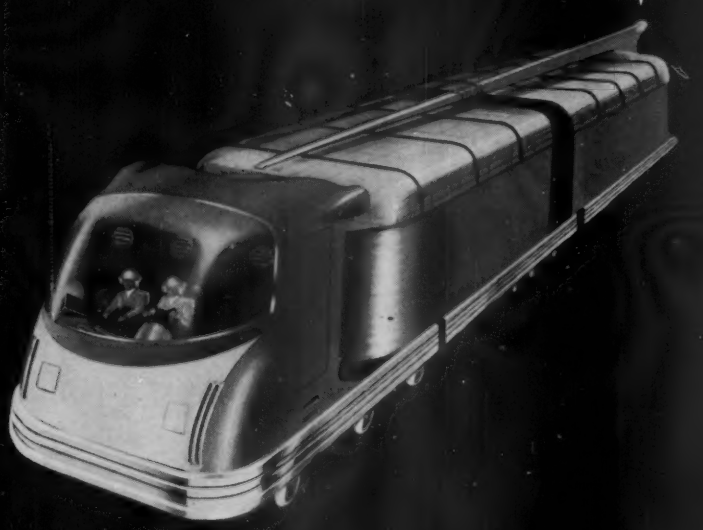

Raw Materials in RUBBER and PLASTICS

H. MUEHLSTEIN & CO. 521 FIFTH AVENUE, N. Y. 17, N. Y.

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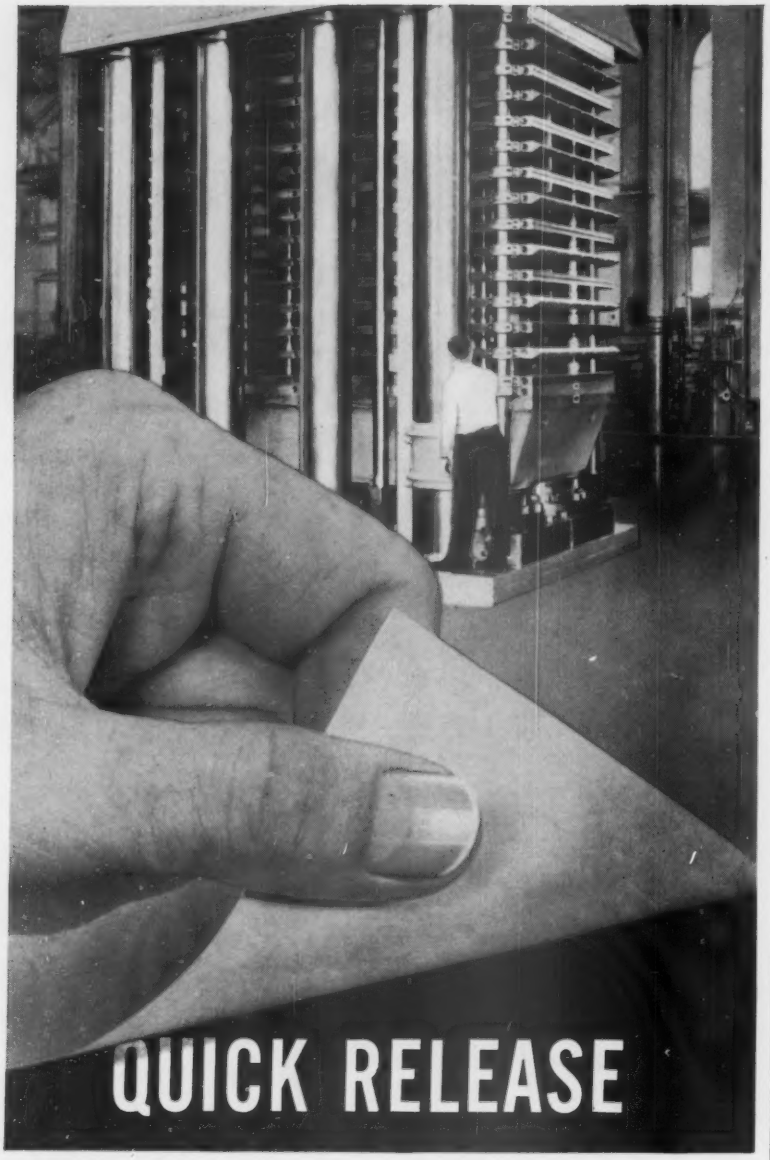


after curing, vulcanizing, polymerizing, casting, calendering

Patapar® Releasing Parchments stay strong during your heating cycle . . . let go when you want quick, clean separation.

Patapar resists penetration and keeps its release characteristic indefinitely.

It has proved invaluable to makers of pressure-sensitive adhesives, synthetic rubber, polyurethane foams, polyesters, vinyl, organosols, phenolics, acrylics, and plastisols. See for yourself. Send for free samples of Patapar Releasing Parchments.

Press Photo Courtesy Baldwin-Lima-Hamilton Corp.

Patapar®
RELEASING PARCHMENT

PATERSON PARCHMENT PAPER COMPANY
BRISTOL, PENNSYLVANIA

Sales Offices: New York, Chicago, Sunnyvale **West Coast Plant: Sunnyvale, California**

News in Brief

► "Accelerated Testing of Ozone Cracking Inhibitors," a reprint of a paper by F. B. Smith and W. F. Tuley, Naugatuck Chemical, Naugatuck, Conn., discusses the effectiveness of antiozonants in tread and sidewall compounds and tells of the division's newly developed outdoor weathering wheel test.

► A new booklet, designed as a reference to Nopco's latex chemicals, and covering a line of latex-compounding chemicals, most of which are nonionic or anionic surfactants, can be obtained from the Protective Coatings Department, Nopco Chemical Co., Newark, N. J.

► Universal Oil Products Co., Des Plaines, Ill., has become a member of the Manufacturing Chemists' Association, Inc.

► A guide to the correct selection of conveyor belts for food and package handling applications has been published by B. F. Goodrich Industrial Products Co., Akron, Ohio. Belts are rated on a selector chart for characteristics such as resistance to abrasion, high temperatures, and oil and grease.

► A technical bulletin published by Sun Oil Co., Philadelphia, Penna., gives data and recommended use for eleven straight distilled Circo Oils with viscosities ranging from 55 SUS at 100°F. to 140 SUS at 210°F. Ask for Technical Bulletin 66.

► The Rubber Manufacturers Association, Inc., New York, N. Y., has published a bulletin entitled "Splicing of Tread Rubber." It is the eleventh in a series of bulletins relating to the retreading and repairing of tires.

► An eight-page brochure, describing the facilities at its new service laboratory in Akron, Ohio, is available from United Carbon Co., Inc., New York, N. Y.

► Enjay Chemical Co. has announced plans for construction of toluene dealkylation facilities for the production of benzene which will nearly double production capacity of benzene and toluene at the Baytown, Texas refinery.

► The Port Neches, Texas, mailing address of Texas-U. S. Chemical Co. has been changed to P. O. Box 667.

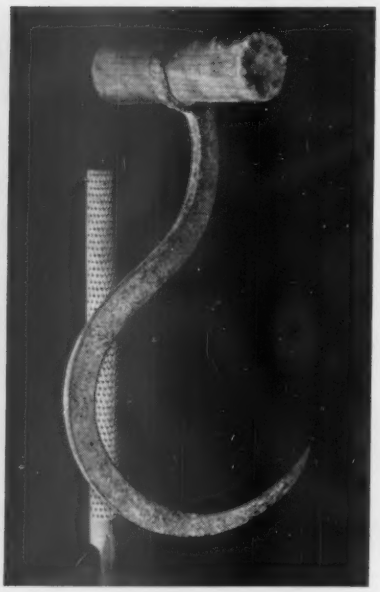
this is the ***rubber*** *we produce*
its qualities are at your service

EUROPRENE

ANIC s.p.a. S. Donato Milanese (Milan) Italy

ENJAY BUTYL

IS TOPS IN ALL-'ROUND



RESISTANCE TO TEAR AND ABRASION

Enjay Butyl offers the highest aged tear strength of any rubber . . . even after long exposure to ozone and heat! Its inherent toughness resists abrasive wear, in such applications as tires, conveyer belts, hose and other mechanical goods.

RESISTANCE TO SUN-LIGHT AND WEATHERING

Enjay Butyl has proven its resistance to ultra-violet light, ozone, oxidation, moisture and mildew. Increases life of products such as weatherstrips, garden hose, wading pools and automotive parts.

RESISTANCE TO CHEMICALS

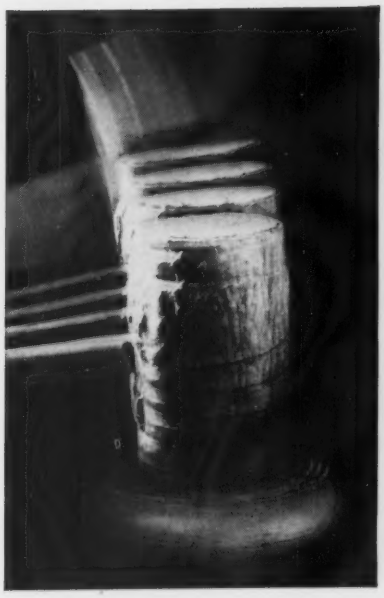
Enjay Butyl, because of its unique and extremely low degree of unsaturation, offers excellent resistance to corrosive chemicals. The preferred rubber for tank linings, hose, seals, gaskets and other applications where exacting chemical resistance is required.

VIVID COLORS

Enjay Butyl requires no additives for quality coloring over a wide range of hues. Famous for colorability and smooth finishes, Butyl has been successfully plastic coated for special applications.

RUBBER

PERFORMANCE



DAMPING PROPERTIES

Enjay Butyl absorbs shock and vibrational energy more completely than any other rubber. Resiliency can be varied in compounding and processing. Butyl is ideal for axle and body bumpers, motor mounts and sound-deadening applications.

IMPERMEABILITY TO GASES AND MOISTURE

Enjay Butyl is tops in impermeability to gases and moisture . . . retains air pressure 8 times better than natural rubber. Outperforms other rubbers in such application as inner tubes, jar and bottle seals, hoses and inflatable goods.

ELECTRICAL RESISTANCE

Enjay Butyl tops all vulcanizable rubbers in electrical and dielectric properties . . . in resistance to corona and ozone breakdown and water absorption. Its high dielectric strength insures against electric breakdown under normal or surge voltage. Its heat resistance permits higher current flow for a given conductor size.

EASY PROCESSING

Enjay Butyl Rubber is a copolymer of isobutylene with a small proportion of isoprene to give it a controlled, low degree of unsaturation. Processing is similar to that of natural rubber except no premastication is required.

The outstanding properties of Butyl Rubber create new horizons for the designer, and offer to manufacturers an opportunity to utilize the qualities of rubber in applications never before possible. The unique properties of Butyl have led to vast improvement in many existing products. Technical skills will open the way to countless new uses.

Butyl is the "idea" rubber with uses stretching as far as the imagination can reach. We'll be glad to tell you all about it. Just contact Enjay at 15 West 51st Street, New York 19, New York.

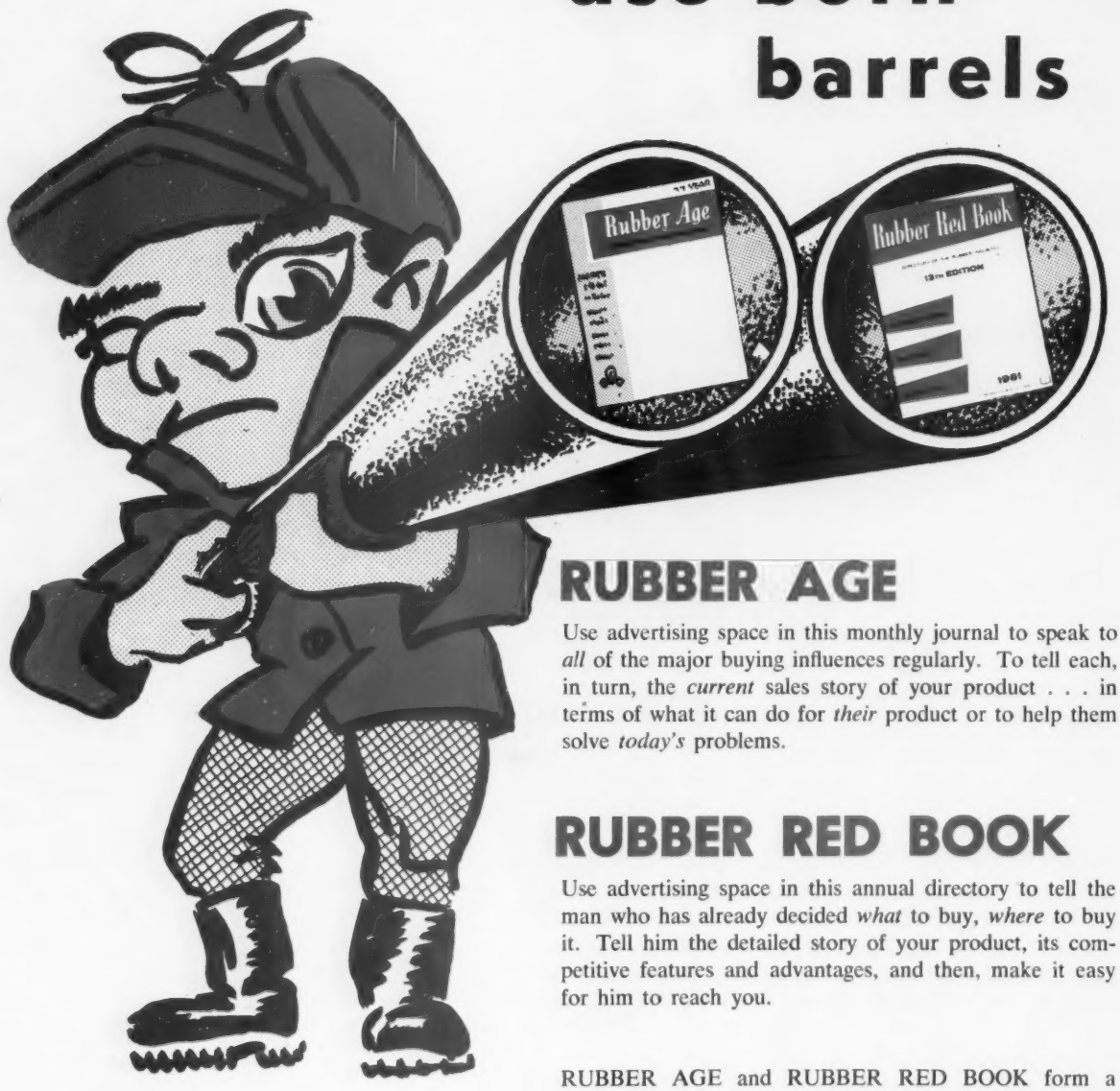
EXCITING NEW PRODUCTS THROUGH PETRO-CHEMISTRY

ENJAY CHEMICAL COMPANY

A DIVISION OF HUMBLE OIL & REFINING COMPANY

ENJAY® BUTYL

use both barrels



RUBBER AGE

Use advertising space in this monthly journal to speak to *all* of the major buying influences regularly. To tell each, in turn, the *current* sales story of your product . . . in terms of what it can do for *their* product or to help them solve *today's* problems.

RUBBER RED BOOK

Use advertising space in this annual directory to tell the man who has already decided *what* to buy, *where* to buy it. Tell him the detailed story of your product, its competitive features and advantages, and then, make it easy for him to reach you.

RUBBER AGE and RUBBER RED BOOK form a powerful combination. They are most effective when used to supplement the efforts of your sales staff because they carry your story to influential people your salesmen never get to see . . . and may not even know.

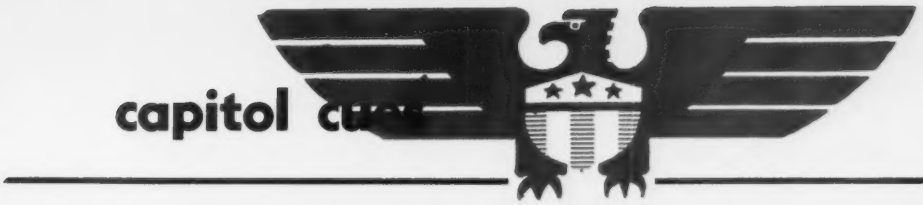
Write today for information on the important buying influences in the rubber industry and learn what kind of advertising appeals to them. Ask for a copy of the booklet, "How to advertise effectively to the rubber industry."

published by

PALMERTON PUBLISHING CO., INC.

Publishers of ADHESIVES AGE • RUBBER AGE • RUBBER RED BOOK

101 West 31st Street • New York 1, N. Y. PE 6-6872



SOME CAUTIOUS OPTIMISM ABOUT THE BUSINESS OUTLOOK is cropping up in Washington these days. President Kennedy's economists see the trend as still downward--but they now think they can see when bottom will be reached. They wouldn't be surprised if it occurred this Spring--by May or even April.

The consumer will help quicken the pace of business. He has been saving at a high rate, but is beginning to need goods. When he does start buying, dealers will have to rebuild stocks. The federal government will provide additional lift. Spending for defense, highways, public works, etc., will be increased soon. Expanded unemployment compensation is coming, too.

Here's the trend of business that the experts now foresee:
-In the first quarter, business will continue to ease further.
-In the second quarter, the trend will level out. Business will begin to feel the effects of larger U.S. expenditures.
-In the third quarter, consumer spending will bring an end to inventory-cutting and federal outlays will keep rising.
-In the fourth quarter, business will pick up a bit more speed.
Even then, it won't be really rolling...just gaining some. Officials fear it will take two years to get things roaring.

YOUR COSTS WILL RISE AGAIN THIS YEAR--wages, taxes, and materials. That's the conclusion we get from analysts in both government and industry. Unfortunately, the rise in sales volume that is expected later in the year won't be great enough to lower unit costs. A squeeze on profits will be the result. Businessmen won't be able to pass cost hikes along in 1961. There are two reasons: Competition will be keener and buyers are price-conscious.

The outlook for price increases is for a gain of about 1% in wholesale prices and 1½¢ to 2% in consumer prices. Industrial goods will firm in the second quarter. Metals will go up first and machinery, lumber, and other building materials later on. Service costs will account for the increase in consumer prices.

Here's the story on wages, industry's largest single cost:
-Wage negotiations will yield an average increase of 9¢ an hour--8¢ or so in manufacturing, 11¢ in nonmanufacturing.
-Escalator clauses in many contracts will bring automatic hikes for part of this--3¢ to 4¢--for 2.8 million workers.
-Fringe benefits will add still further to labor costs.

This is what you can expect on taxes as the year moves along:
-At the state-local level, new income taxes and sales and gas levies will noticeably increase the costs of doing business.
-At the federal government level, business can expect higher payroll taxes to finance a big unemployment insurance program. Social security taxes may go up, too if President Kennedy's program for medical care for the aged is adopted.

capitol cues (cont'd)

THIS MAY BE AS GOOD A TIME TO BORROW as any that's likely in 1961. That's the view of a growing number of monetary specialists. They look for very little, if any, further decline in rates of interest. An early end to the recession is the leading reason for this. In other words, the demand for loans will begin to increase soon. Most experts in Washington believe that the Federal Reserve Board won't let interest rates ease much further.

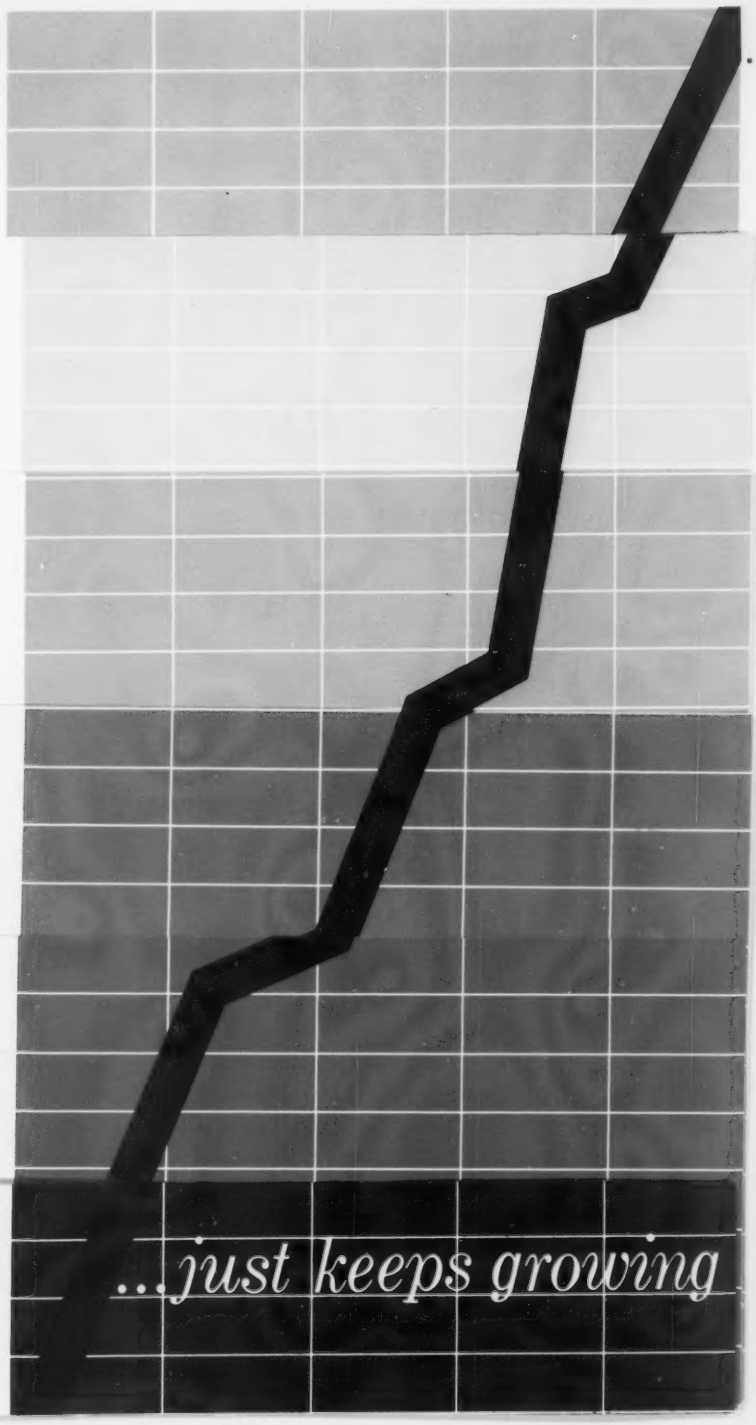
THE PRODUCTIVITY OF AMERICAN INDUSTRY ISN'T EXPANDING as fast as it has in past years. During 1960, the output per man-hour for all manufacturing workers went up only 2.7%, compared with a 6.8% gain in the prior year. What is worse, the index halted its rise last Winter; it is down about 1% from the 1960 high. And this measurement of output may fall more before rising again. Since 1957, output per man-hour of all manufacturing employees went up 11.4%. Over that same period, government experts say wages and fringes rose 13%.

LABOR NEGOTIATIONS WILL BE FAIRLY ROUGH THIS YEAR. All signs point to a tough attitude by management and a refusal to give ground on sweeping union demands. Labor leaders realize that rising unemployment will reduce their bargaining power but they expect some help from the new Administration. The unions will center their demands on retention of escalator clauses, on expansion of severance pay and on efforts to establish shorter work-weeks. On wage rates, as already noted, settlements will average around 9¢ an hour.

> The settlement of the tug-boat dispute in New York in January set a pattern: It showed that the Kennedy Administration won't stand by while major strikes cripple the economy. Secretary of Labor Goldberg moved in quickly and worked out a formula to get the trains running again. In the future, he may move to intervene--before strikes reach the disaster state--using the President's influence and prestige to shorten or avert walkouts.

SOME IMPORTANT TAX CHANGES ARE LIKELY THIS YEAR. The new President's advisers, including Treasury Secretary Dillon, have already singled out some objectives for action at this session of Congress. Their aim is to get a set of recommendations to Congress by April 1, in time for action before Congress adjourns. They aren't talking about a temporary tax reduction which may come if business gets worse. They want to plug loopholes and spur investment.

> Here's what Kennedy's advisors probably will recommend:
> -Repeal of the dividend credit--a Democratic campaign promise.
> -Withholding taxes on dividends by the paying firm. This is aimed at collecting large sums now said to be escaping taxes. Withholding taxes on interest payments isn't being considered now. The large number of small interest-payers is a problem.
> -Tightening up on expense accounts to end what Kennedy people term abuses--indirect benefits in lieu of salary increases.
> -Liberalizing depreciation allowances, to encourage business investment in new equipment. One idea is to exempt from taxes outlays in excess of depreciation being taken. Also under study is allowing depreciation at replacement value.
>
> Congress probably will buy the bulk of this package. Kennedy will sell it as a first step in a long-range program to reform the Tax Code and bring reductions in rates for individuals.



CABOT

.....and growing.... to serve your carbon black needs better – no matter where in the world you are.

CABOT

REGAL:

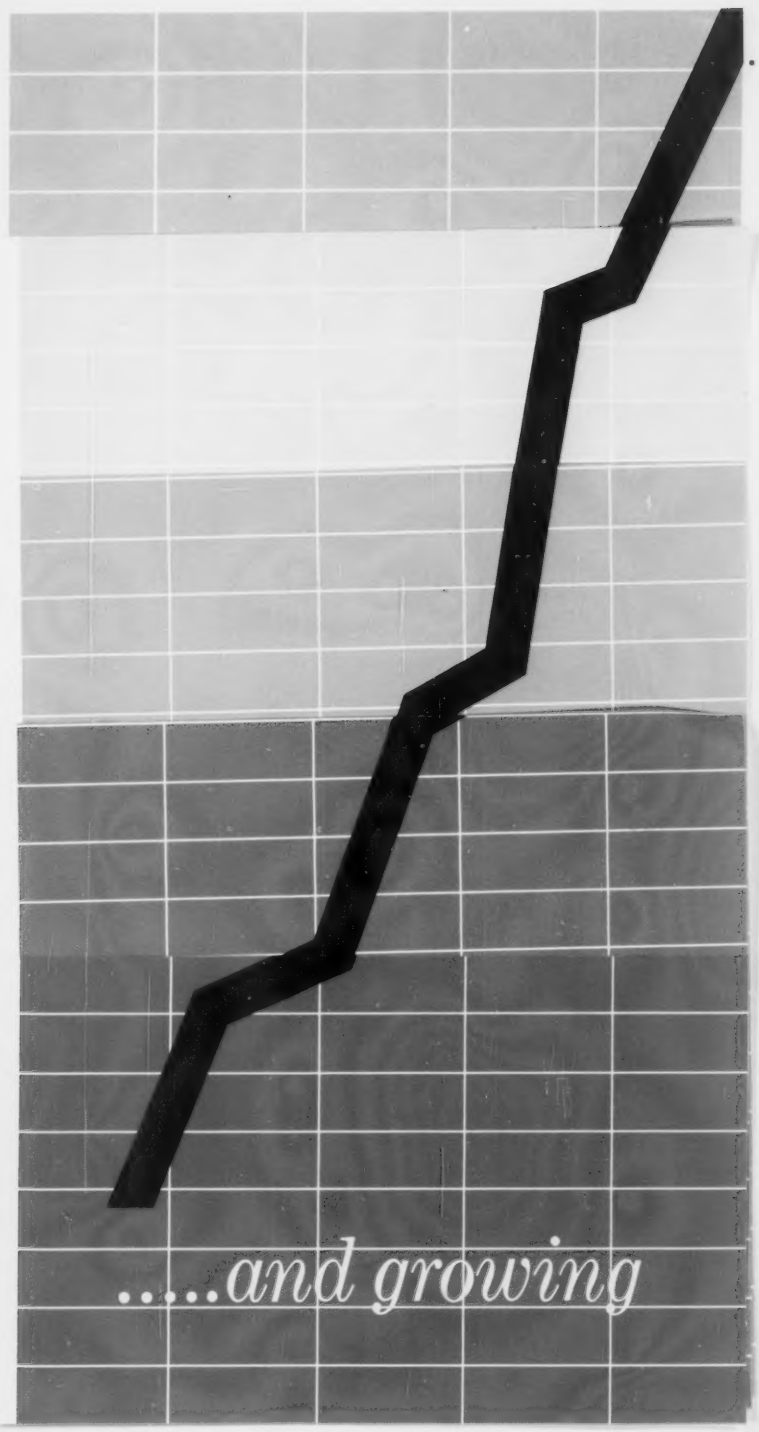
FURNACE:

THERMAL:

CHANNEL:

1950 . . . a new plant in

GREAT BRITAIN



.....*and growing....*
to serve your carbon black needs better – no matter where in the world you are.

CABOT

REGAL:

FURNACE:

THERMAL:

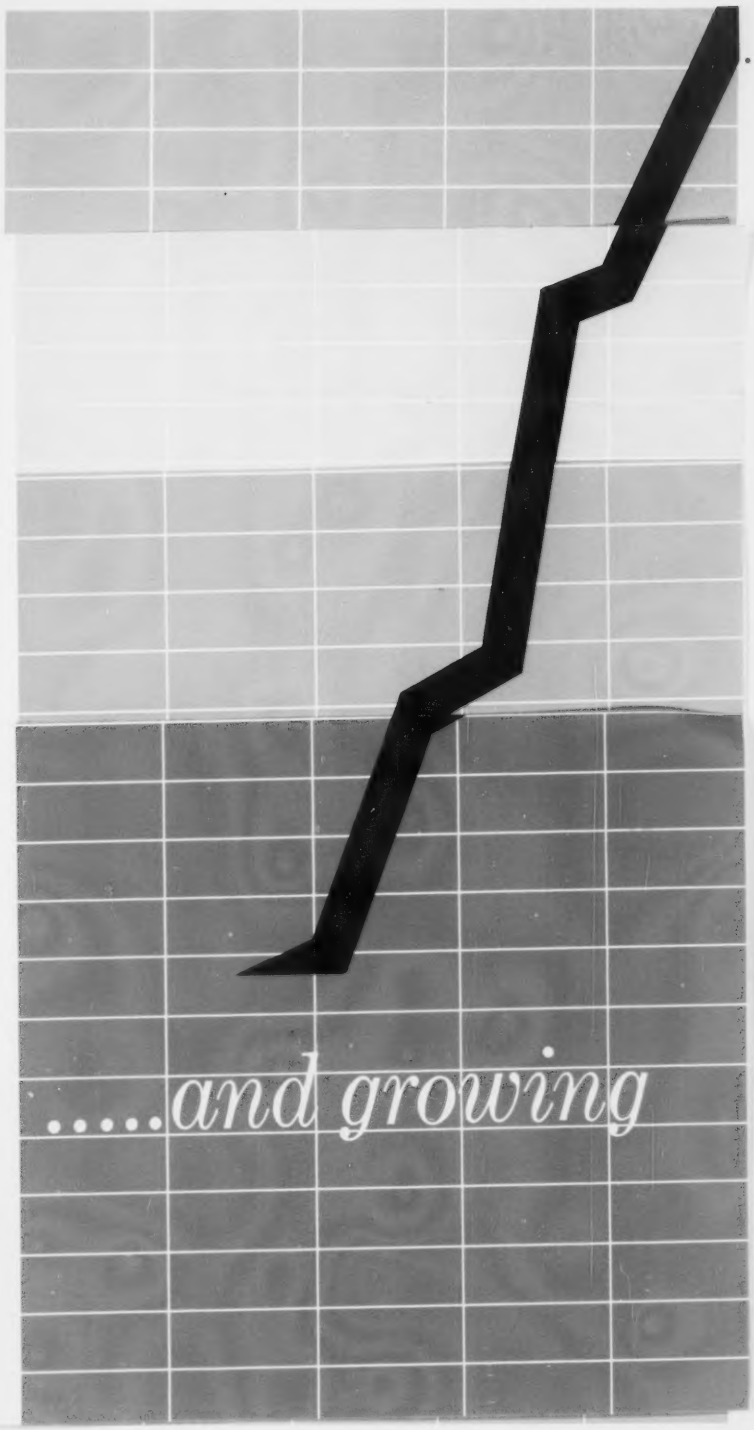
CHANNEL:

CABOT

1953

. . . a new plant in

CANADA



.....*and growing....*
to serve your carbon black needs better – no matter where in the world you are.

CABOT

REGAL:

FURNACE:

THERMAL:

CHANNEL:

CABOT

1957

. . . a new plant in

FRANCE

.....and growing....
to serve your carbon black needs better – no matter where in the world you are.

CABOT

...and growing

CABOT

REGAL:

FURNACE:

THERMAL:

CHANNEL:

1959

. . . a new plant in

AUSTRALIA

(Jointly Owned)

1960

. . . a new plant in

ITALY

..and growing

CABOT

.....and growing....
to serve your carbon black needs better – no matter where in the world you are.

CABOT

REGAL:

FURNACE:

THERMAL:

CHANNEL:

1961

. . . and now!

ARGENTINA

Just a short forty miles away from Buenos Aires, Cabot's new plant at Campana will be completely equipped with the latest production facilities, implemented by analytical, quality control and rubber testing laboratories to serve the needs of the fast-growing South American rubber industry.

...and growing

A new 30-million pound per year carbon black plant, now being built by Cabot near Buenos Aires, will be serving the fast-growing needs of Argentina and its neighbors within a year.

The new plant marks the latest step of Cabot Corporation to expand production facilities along an international front in order to provide faster, more economical service to the rubber industry throughout the world.

The new plant will be able to produce the complete range of Cabot blacks . . . blacks previously available only by import . . . including the new REGAL blacks, developed by Cabot research and produced by a new and exclusive manufacturing process from oil.

CABOT

. . . . . and growing . . . . to serve your carbon black needs better – no matter where in the world you are.

CABOT

REGAL:

FURNACE:

THERMAL:

CHANNEL:

- Cabot produces more different grades of carbon black than anyone else — and sells more — not only in the U.S. but throughout the world. On all six continents. In 58 different countries.
- Cabot has more production facilities abroad than anyone else. Ships from more countries. Sells in more currencies. Serves your carbon black needs better . . . no matter where in the world you are.

CABOT CORPORATION

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AKRON 8, OHIO — 518 Ohio Building
CHICAGO 4, ILLINOIS — 141 West Jackson Boulevard
DALLAS, TEXAS — 1309 Main Street
LOS ANGELES 5, CALIFORNIA — 3350 Wilshire Boulevard
NEW BRUNSWICK, NEW JERSEY — 46 Bayard Street
NEW YORK 17, NEW YORK — 60 East 42d Street

Cabot Argentina S.A.I.C., Sarmiento 930-2°A, Buenos Aires, Argentina
Cabot Carbon of Canada, Ltd., 121 Richmond Street West, Toronto 1, Ontario, Canada
Cabot Carbon Limited, 62 Brompton Road, London, S. W. 3, England
Cabot France S.A., 45, rue de Courcelles, Paris 8, France
Cabot Italiana S.p.A., Via Larga 19, Milano, Italy
Cabot Europa, 45, rue de Courcelles, Paris 8, France
Australian Carbon Black Pty. Limited, Millers Road, Altona, Victoria, Australia (jointly owned)

Printed in U.S.A. March 1961

Question:

Looking for a good non-staining rubber anti-oxidant?

Answer:

Then you should consider the Neville Nevastains — Nevastain A, if you prefer liquid form and Nevastain B, in solid, flaked form for ease of weighing and handling. Both Nevastains are highly compatible with synthetic or natural rubbers, and result in a desirable retention of tensile strength, elongation, hardness and color after aging. The non-staining aspects of the Nevastains make them ideally suited to light-colored stocks. They are much lower in price than their virtues would indicate. Write for Technical Service Reports.

	Nevastain A	Nevastain B
Specific Gravity @ 15.6/15.6°C....	1.080-1.090	1.090-1.110
Color	Straw	Light Amber

Neville Chemical Company · Pittsburgh 25, Pa.

NEVILLE®

Time out for admiration with TITANOX®

TITANOX titanium dioxide pigments add eye-catching beauty and sales appeal to a wide range of rubber and plastic products—including white and light-colored luggage that attracts admiring glances.

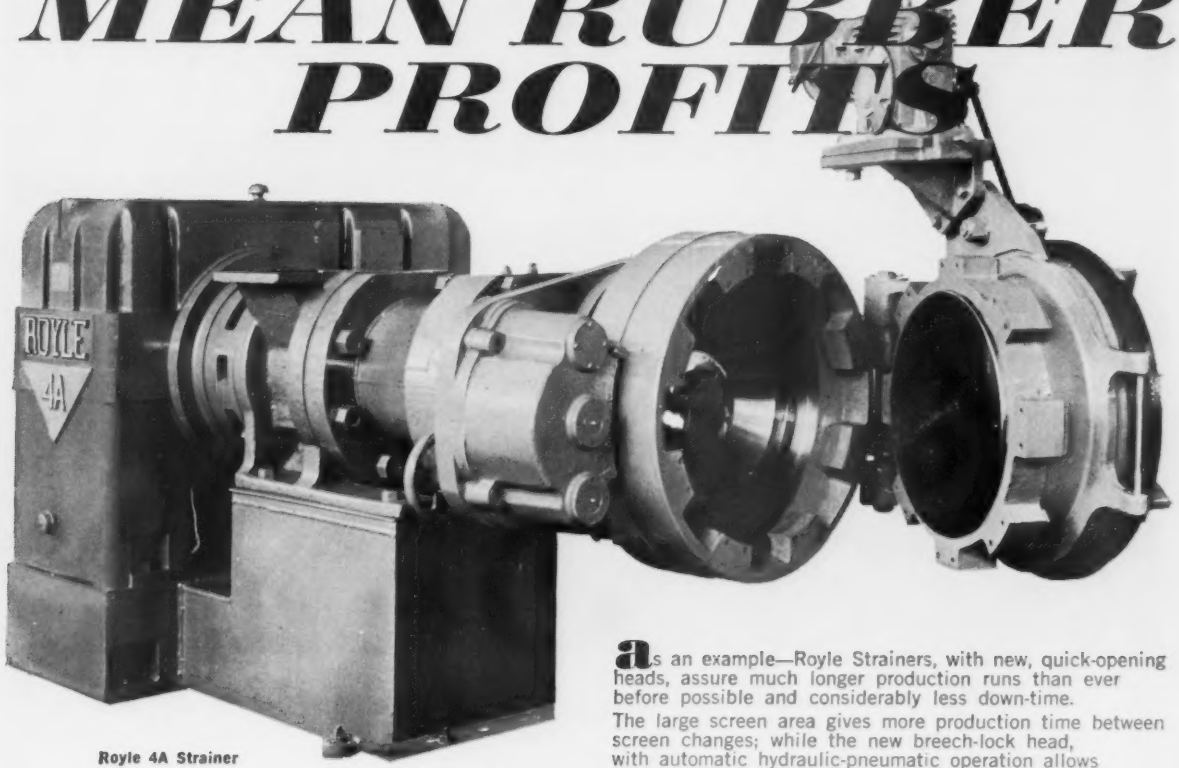
For many rubber and plastic products TITANOX-RA or TITANOX-RA-50 provide outstanding whiteness, brightness and opacity. Where weather resistance is of prime importance TITANOX-RA-NC may be preferred. Also new TITANOX-RA-40, rutile TiO_2, yields clean, bright whites and sharp tints at economically low loadings in many compositions. No matter which you choose, all TITANOX pigments have the ease of dispersion and uniformity that increase production efficiency.

For complete information on the type of pigment to meet your requirements, consult our Technical Service Department. Titanium Pigment Corporation, 111 Broadway, New York 6, N. Y.; offices and warehouses in principal cities. In Canada: Canadian Titanium Pigments, Ltd., Montreal. 7909

TITANIUM PIGMENT CORPORATION
SUBSIDIARY OF NATIONAL LEAD COMPANY

Division of Rubber Chemistry—A. C. S. Convention—Louisville, Kentucky—April 19, 20, and 21

ROYLE STRAINERS MEAN RUBBER PROFITS



Royle 4A Strainer

As an example—Royle Strainers, with new, quick-opening heads, assure much longer production runs than ever before possible and considerably less down-time.

The large screen area gives more production time between screen changes; while the new breech-lock head, with automatic hydraulic-pneumatic operation allows for quick screen changes.

There are many other practical advantages built right in to Royle Extruders, for instance:

Heavy Duty Gear Case—with self-lubricating, opposed helical gears that were Royle designed and engineered specifically for strainer operations.

Powered Cut-Off Knife—with either rotary or up-and-down motion and adjustable cycling to give variable length products.

Longer L/D Ratios—allow mixing operations to be performed in the extruder. This gives a continuous and, hence, more economical mixing method than other operations.

Write today for complete Royle Strainer information. There is no obligation on your part.

ROYLE
Paterson, N. J.

John Royle & Sons, 4 Essex Street, Paterson 3, N. J.

Please, send me full information about Royle Strainers.

Name_____ **Title**_____

Company_____

Street_____

City_____ **Zone**_____ **State**_____

JOHN ROYLE & SONS

Pioneered the Continuous Extrusion Process in 1880

Home Office, V. M. Hovey, J. W. VanRiper, SHerwood 2-8262. **Akron, Ohio,** J. C. Clinefelter Co., BLackstone 3-9222. **Downey, Cal.,** H. M. Royal, Inc., TOpaz 1-0371. **London, England,** James Day (Machinery) Ltd., Hyde Park 2430-0456. **Tokyo, Japan,** Okura Trading Company, Ltd., (56) 2130-2149.

Now you can greatly increase warehouse space at no increase in cost with...

AZODOX high apparent density zinc oxides

- Easier to Handle
- Stacks Higher, Safely
- Less Bag Breakage
- Close-Packed, Unitized Shipments

AZODOX stores in much less space than other zinc oxides. That's because you get many more pounds of AZODOX per cubic foot of pigment—up to 62 lbs. per cubic foot! Save valuable space for other purposes with every ton of AZODOX you buy.

In the manufacture of AZODOX, an exclusive process removes excess, space-wasting air from between individual particles of zinc oxide. Actual pigment density and every other desirable property remain unchanged. High apparent density AZODOX flows freely yet dusts less, incorporates fast and disperses thoroughly.

AZODOX is available in the following grades at no additional cost over conventional zinc oxides:

	Bulk Density lbs./cu. ft.	Rate of Activation	Reinforcement Properties
AZODOX-44 (Conventional)	60	Medium	High
AZODOX-55 (Conventional)	60	Fast	High
AZODOX-55-TT (Surface Treated)	62	Fast	High
AZODOX-550 (Conventional)	58	Medium	High

For technical data, fill in and mail this coupon.

AMERICAN ZINC SALES COMPANY
1515 Paul Brown Bldg., St. Louis 1, Mo.

Please send me technical information about . . .

☐ AZODOX-44 ☐ AZODOX-55-TT
☐ AZODOX-55 ☐ AZODOX-550
☐ 15 types of AZO brand zinc oxides

Name.....Title.....
Company.....
Address.....
City.....Zone....State.....

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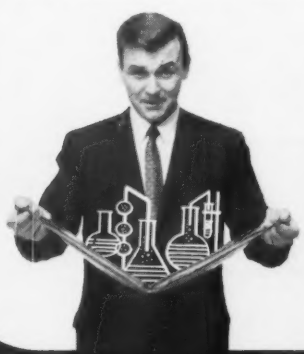
Columbus, Ohio • Chicago • St. Louis • New York

Better... from VELSICOL

When you use Velsicol Hydrocarbon Resins, rubber takes a fast TACK!

Velsicol X-30 is a light colored resin that can be used in light colored, pastel shade pigmentations. It is an ideal softener and tackifier that keeps stocks pliable and easy to process. Velsicol's X-30 permits the highest loadings with no loss in quality, yet it makes rubber tougher, longer wearing and *more profitable!*

Work with this man . . .
Your Velsicol representative, a qualified chemist who can help you make better products for less!



VELSICOL *for quality resins, constant in supply, stable in price!*

Try them now and discover their advantages for new production convenience and economy.

FREE X-30 test samples and literature

VELSICOL CHEMICAL CORP., 330 E. Grand Ave., Chicago 11, Ill. RA-31
INTERNATIONAL REPRESENTATIVE: VELSICOL INTERNATIONAL CORPORATION, C.A. P.O. BOX 1687 • NASSAU, BAHAMAS, B.W.I.

☐ Please send test samples of Velsicol X-30 Hydrocarbon Resins.
☐ Please send complete technical data. ☐ Have representative call.

NAME_____
COMPANY_____
ADDRESS_____
CITY_____ ZONE_____ STATE_____

VELSICOL

TOP QUALITY BECOMES ECONOMY AS KVP RELEASING PAPER IS USED AND RE-USED

KVP® Releasing Paper is in constant use at the Goodyear Tire and Rubber Company's plant in St. Mary's, Ohio. It is ideally suited to the handling of the highly-adhesive rubber products manufactured in this plant.

Below we see one of the steps in the production of diaphragms for industrial use. Layers of rubber are cemented together and assembled on trays covered with sheets of KVP Releasing Paper. Though extremely sticky on all surfaces, the rubber parts never cling to the releasing paper, even when weight-pressure mounts as the trays are stacked high. Nor does the paper shred, defibre or lint on to the rubber.

Yet, the high quality of KVP Releasing Paper becomes an *economy* for Goodyear because of its re-use factor. Not until the heat-treating stage is the KVP Releasing Paper discarded—then *only* because it becomes impractical to reclaim.

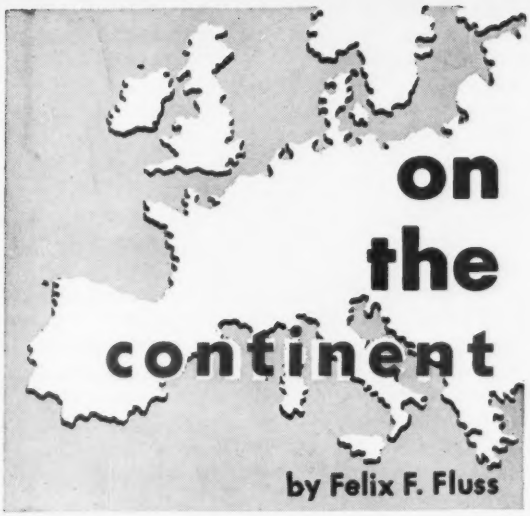
Most KVP Releasing Papers are tailor-made for a specific job. This is only one of many such papers produced by KVP Sutherland. It might meet your own needs. If not, we can almost certainly develop one for you that will.

We solicit the chance to solve your "sticky problems." Please write to Dept. RP3.

KVP SUTHERLAND

...the paper people

KVP SUTHERLAND PAPER COMPANY... Kalamazoo, Michigan



• **German Tire Export Problems.** Germany is complaining bitterly about the developments in its tire exports which are unfavorably influenced by developments in the European Market. Tires manufactured in the five other member states of the European Common Market are subject to an import duty of 20.8 per cent when shipped to West Germany. However, when German tires are exported to the five member states, much higher import duties and taxes have to be paid. Italy collects 29.5 per cent, Belgium and Luxembourg 30.2 per cent, The Netherlands 46 per cent, and France as much as 49.7 per cent. Germany stresses the point that it is time to decrease these exaggerated protective duties.

According to West Germany even after the periodical reduction of duties in accordance with the treaty, some member countries nullify such reductions by increasing taxes. Italy has used such a method. After reducing the duties by 2 per cent, the turnover tax was increased by 3 to 5 per cent, thus completely eliminating the reduction as stipulated in the Treaty of Rome. Similar tactics were followed by the Benelux countries. Germany has appealed, particularly to France, to eliminate its inflated duties. The French tire industry has gained considerably due to the expansion of French automobile production. Because of the very high import duties, almost 50 per cent of the value of the merchandise, the French tire industry practically enjoys a monopoly. On the other hand, France has no difficulty in bringing her tires into Germany and competing successfully with the domestic manufacturing plants.

• **American versus European Marketing Philosophy.** An American factory producing an item which sells very well and shows tremendous possibilities of increasing sales, will try to enlarge its production as quickly as possible in order to obtain a major share of the market. The following clipping from *Duesseldorfer Nachrichten* of January 31, characterizes the different European viewpoint:

"The Dr. F. Porsche KG, Stuttgart, manufacturers of the well-known Porsche sports cars, will increase production from 31 to about 50 Porsche cars per day. Management does not intend to increase, within the near future, production above 50 cars a day in order to safeguard the character of the individual car in the future."

In view of the fact that the European Common Market will enable the Porsche works to supply a population of over 120 million people, it is doubtful whether management will adhere to the stated policy in the "near future."

• **Soviet-Built Tire Factory in Ceylon.** Construction of a tire factory near the capital city of Colombo will start shortly. Soviet Russia will construct the project, using a credit of about $9 million, with an estimated initial annual capacity of 250,000 tires and tubes. The output of the factory will be increased after several years to 360,000 and will finally be enlarged to a maximum capacity of 600,000 tires and tubes. Because Ceylon uses approximately 100,000 tires a year and will double its consumption within the next few years, a major part of the production of the new factory will be exported to adjacent countries.

• **Discount of Rubber Goods.** The 46 German technical rubber goods manufacturers, who recently formed a cartel, are offering to their customers an annual discount on all purchases made from any manufacturer in the cartel.

• **Two Belgium Firms Merge.** International Rubber S.A. Usines Gheysen et Seneffe Rubber Company (Interubber) is the new corporate name of the two merged Belgian companies, Seneffe Rubber Cy., Seneffe, and the Manufacture Generale du Caoutchouc et de Matieres Plastiques Usines Gheysen S.A., Lembecq-Hal (Belgium). The capital of the new corporation has been increased to approximately $7.5 million. The following German corporations are also major shareholders of the new company: Metzeler Gummiwerke AG; Gummiwerke Odenwald GmbH, Correcta Werke GmbH; and the Trefileries L. Bekaert.

• **German Tire Cartel Litigation.** In previous issues we reported about the refusal of the German Cartel Office to allow the formation of a German tire cartel. The German tire industry has protested against this decision and, consequently, a number of hearings have taken place. Because the tire industry wanted to be present when witnesses of the wholesale and retail trade stated their opinions, but were prevented by governing rules of the Cartel Office, the tire industry succeeded in having the case transferred to the regular court. There, no restrictions exist concerning the presence of any party when witnesses are on the stand. During a session of the regular court in Berlin on February 17, the court had decided to take over the entire procedure. Since this

is the first case where the Cartel Office is superseded by a regular court, great interest prevails in Germany concerning the final decision which will be rendered within a few weeks.

• **European Common Market Meets.** ECM delegates met on February 20 in Rome in order to straighten out the difficulties caused by Italy's reducing its import duties for merchandise originating in the five other member countries. Italy, in order to nullify the effect of the reduction, had increased its sales tax. Italy has not only applied this tactic in the rubber field, but has done the same thing to protect itself against increased imports of cigarettes, cigars, and tobacco. The other partners of the European Common Market are not very happy about these shenanigans.

• **Germany Increased Production of Rubber Goods During 1960.** Compared with 1959, production of rubber goods of all kinds in Germany has increased during 1960 by 11.4 per cent and reached 530,000 tons. In 1959 475,000 tons were produced. The output of tires in 1960 was increased by 15 per cent and reached 231,000 tons. The production of technical rubber goods was up 15 per cent and attained a volume of 273,000 tons. Other rubber goods, such as repair material, packings, etc., had only increased 8 per cent. During 1960, the German rubber factories used approximately 100,000 tons of synthetic rubber, while in 1959 only 65,166 tons were processed.

• **German Chemical Firm Expanding.** Enlarging of Erdoelchemie GmbH, Dormagen (Germany) is proceeding according to plan. During January of this year the company started production of butadiene, with an annual capacity of 30,000 tons. Part of the shares of the company, amounting to $25 million, are owned by Farbenfabriken Bayer AG, Leverkusen, one of the successors of the I.G. Farben combine; other shares are owned by BP Benzin- und Petroleum AG, Hamburg.

• **Furniture Fair in Cologne.** INTERZUM, the 2nd International Fair of Suppliers to the Furniture, Upholstery and Wood Processing Industries, to be held in Cologne from June 8 to 11, will cover a display area of nearly 9 acres and offer a comprehensive display of materials, upholstery goods, surface treatment products, workshop equipment, and other accessories. Two hundred eighty firms from Germany, and a number from other countries, have already reserved space. Since a number of new developments in the field of foam rubber and plastic foams will be shown at this fair, it might be interesting to visit Cologne during the month of June. A trip to Europe at that time of the year is very rewarding because the weather is usually very nice. Spring has reached its full bloom, and hotels and means of transportation are not yet crowded, because vacations start a month later.

• **Butyl Rubber To Obtain Larger Share of German Tire Market.** Recently, a representative of the petrochemical division of the Esso Company, addressed a gathering of German automobile journalists, discussing the application of butyl rubber in the modern automobile. The speaker pointed out that this synthetic rubber was discovered about 20 years ago by accident in a research laboratory in the United States. Since that time it has been common knowledge that synthetic rubber can be manufactured from crude oil.

A film was shown illustrating the various research and development efforts, indicating the tremendous possibilities of application of this synthetic rubber. Petrochemical research has opened up a gratifying and rewarding field of endeavor for the oil industry. In this connection the speaker stated that the Standard Oil Company of New Jersey (Esso) belongs among the largest chemical concerns of the world. America at the present time is using many items made from butyl in the modern automobile; almost all tubes are made from butyl rubber. Presently, butyl rubber is not manufactured in Germany, but is imported from France. America has succeeded in manufacturing butyl tires which have, compared with the other rubber tires, a number of advantages.

The time has come for the German rubber industry and, to a larger extent, the German automobile industry, to become interested in developing suitable tires and parts made from butyl rubber. Based upon extensive research and development efforts, the German industry will undoubtedly succeed in providing the automobile industry and the automobile owner with butyl rubber tires which have distinctive advantages over the present products.

• **Israeli Tire Prices Too High?** The two Israeli manufacturers of tires, the Alliance Tire and Rubber Co. and the Samson Tire Co., will have to reduce their prices in order to remain competitive in various export markets. Both companies nearly finished the enlargements of their factories. Last year, both companies produced 11,000 tons of tires compared with 8,800 tons in 1959. This year, an annual volume of about 13,000 tons can be expected. In 1960, both factories were able to increase their exports by 30 per cent and reach an export volume of $7.9 million. Due to the fact that the prices for tires on the world market are slowly decreasing, the Israeli factories will have to adjust their prices. Israel itself has only a limited capacity for the sale of tires.

• **Fundamental Problems of Latex Technology.** Latex technology problems were discussed in the East German trade paper *Plaste und Kautschuk*. The author of the article states that influences on the size, frequency and shape of particles of the psysicochemical behaviour of latices have been investigated. A measuring chamber containing ultra-centrifuge is used to measure the particle size (results are indicated). Special attention is given to latex rheology, and a description of all types of viscosimeters.

Ameripol Rubber helps ball maker bounce back into competition

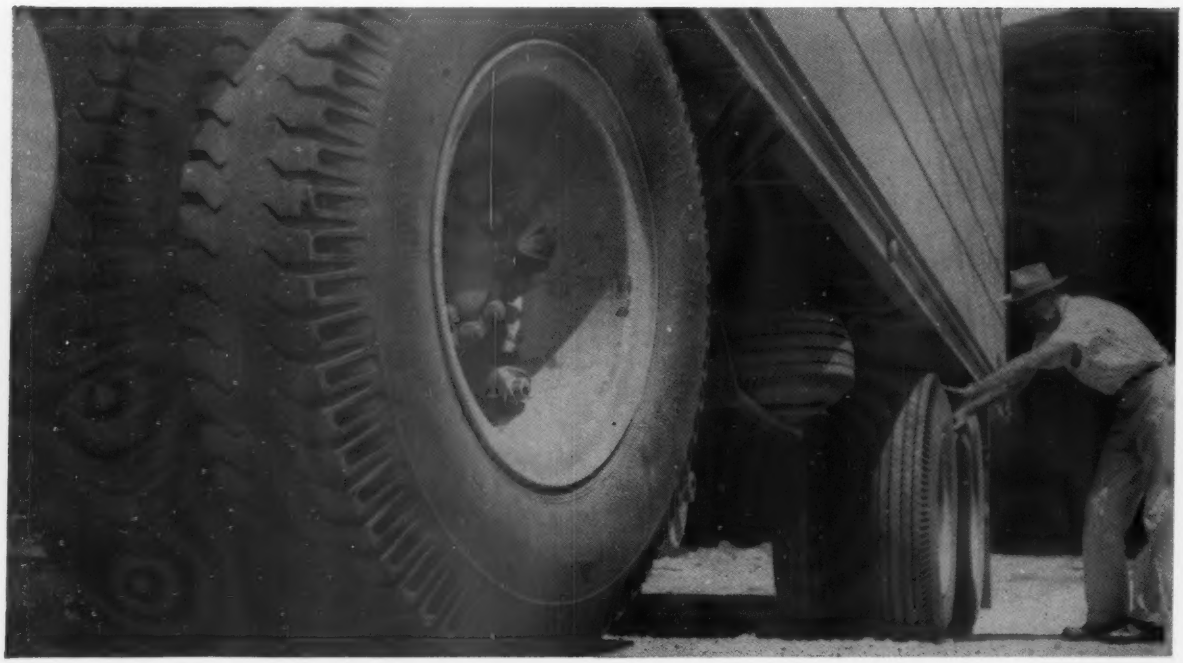
Intensified competition in selling sponge rubber balls inspired a thorough cost study by Barr Rubber Products Company. To help make it, they called in a Goodrich-Gulf sales engineer. A switch from natural rubber to an Ameripol synthetic rubber polymer really produced results. Barr was able to cut its raw material costs substantially. Quality of the end product is maintained at the same high level, and processibility improved. If you make or use rubber products, check Goodrich-Gulf. We produce the broadest range of synthetic rubber polymers, and offer complete technical service that can help you make improvements. Contact Goodrich-Gulf Chemicals, Inc., 1717 East 9th Street, Cleveland 14, Ohio.

Ameripol
THE PREFERRED RUBBER

Goodrich-Gulf Chemicals, Inc.

WORLD'S LARGEST SOURCE OF SYNTHETIC RUBBER

NEWS FROM GOODRICH-GULF



NEW SYNTHETIC RUBBER CAN REPLACE NATURAL 100% IN HEAVY DUTY TIRES

Goodrich-Gulf is now proceeding with a multi-million dollar plant for the commercial production of Ameripol CB (cis-polybutadiene) rubber. CB is the only known polybutadiene rubber which can be used as a 100% replacement for natural rubber in heavy duty tire treads.

In over 5 million miles of test driving on Ameripol CB tire treads, up to double the tread life of natural rubber has been achieved. Superiority is greatest in very severe conditions including heavy loading, long distances, and high-speed turnpike driving.

The first Goodrich-Gulf plant unit will produce at an annual rate of 20 million pounds. In addition, other companies will produce CB under license.

Ameripol CB has qualities which may be advantageous in applications beyond tires. Good electrical properties, abrasion resistance can provide superior coverings for electrical wires that are subjected to mechanical wear. Outstanding flex properties suggest superior performance in power transmission belting and conveyor belting.

This new development complements Goodrich-Gulf's production of Styrene-Butadiene Rubber (SBR) in non-pigmented hot, cold, and oil-extended types; and micro-black masterbatch cold, and cold oil-extended types.

Ameripol
THE PREFERRED RUBBER

PROCESSING COSTS CUT WITH NEW MEDIUM-LOW VISCOSITY SBR

Newest addition to the Ameripol SBR family, Ameripol 4604, has the combined features of a high bound styrene with a minimum-low raw Mooney viscosity in the range of 30 to 42.

The high bound styrene content, together with medium-low viscosity, results in a cold polymer with excellent processing characteristics. Time is saved, and need for peptizing agents is eliminated.

TYPICAL PHYSICAL PROPERTIES

(Based on test recipe of 100.0 parts Ameripol 4604, 40.0 parts EPC Black, 5.0 parts zinc oxide, 1.5 parts stearic acid, 2.0 parts Benzothiazyldisulfide, 2.0 parts sulfur).

Raw Viscosity, ML-4 @ 212°F.		40
Compound Viscosity, ML-4 @ 212°F.		51
	Cure @ 292°F.	
Tensile, psi	50′	3080
Elongation, %	50′	745
Modulus, 300%, psi	25′	310
300%, psi	50′	830
300%, psi	100′	1260

Light color, low viscosity, outstanding physical properties, and low water absorption qualify Ameripol 4604 for products such as:

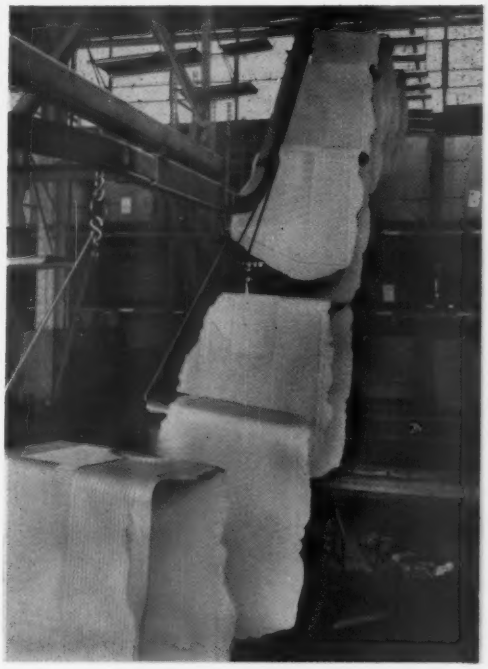
Closed Cell Sponge • Calendered Goods • Open Cell Sponge • Transfer Molded Items • Cements • Coated Fabrics • Adhesives • Hard Rubber

AMERIPOL 4700 CUTS FLOOR MAT COST

Each one of these automobile floor mats coming down the conveyor line at Anchor Industries, Inc., Cleveland, represents a savings over the previous rubber polymer used.

The mats are made from Ameripol 4700, which is a 50-part oil-extended rubber; thus costs substantially less than low-oil polymers. Ameripol 4700 maintains the high quality level this company has established; permits processing in a range of colors.

Since Goodrich-Gulf produces the broadest range of SBR polymers, we are in excellent position to help you in selecting the type which exactly meets your needs.



Goodrich-Gulf Chemicals, Inc.

1717 East Ninth Street • Cleveland 14, Ohio

Ameripol
THE PREFERRED RUBBER

YOU GET THE WIDEST SELECTION OF SBR POLYMERS FROM GOODRICH-GULF ...WITH TECHNICAL SERVICE TO HELP YOU IN PROPER APPLICATION

Ameripol NON-PIGMENTED RUBBERS

NON-PIGMENTED HOT RUBBERS

1000 Staining. General purpose rubber, easy processing, good aging, for wide range of molded and extruded products.

1001 Slightly staining. General purpose rubber, similar to Ameripol 1000, used where less discoloration is required.

1002 Staining. Similar to Ameripol 1000, exhibits more tack in processing.

1006* Non-staining. General purpose rubber for light colored and white products.

1007 Staining. Good electrical resistance properties. Reduced water absorption.

1009* Non-staining. Has little or no nerve in milling, used as a processing aid in other rubbers.

1011 Non-staining. Tackier in processing than Ameripol 1006, used in adhesives, tapes, molded and extruded goods.

1012* Non-staining. High Mooney 1006. Ideal for cement applications. Excellent flow characteristics and high green strength in compounded stocks. Used to increase tensile and hardness in non-black stocks.

1013* Non-staining. High bound styrene content provides greater thermal plasticity and excellent flow characteristics.

1019 Non-staining. Glue acid coagulated. Low ash content and special finishing result in a polymer that is excellent for wire and cable applications.

*Available in either bale or crumb form.

NON-PIGMENTED COLD RUBBERS

1500 Staining. General purpose cold rubber, better physicals, usually better processing than hot rubbers.

1501 Slightly staining. Similar to 1500, better resistance to staining and discoloring.

1502 Non-staining. General purpose rubber for light colored and white products.

1503 Non-staining. Cold version of Ameripol 1019 for wire and cable applications.

1509 (formerly 4601) Non-staining. Coagulated with Alum making it suitable for low water absorption applications. A medium low viscosity polymer.

1511 (formerly 4600) Non-staining. For light colored and white products. Good physicals on aging. Fast pigment incorporation. Reduced Mooney viscosity.

4604 Non-staining. High bound styrene polymer which is extremely suitable for sponge work, both open and closed cell. Has good processing characteristics.

NON-PIGMENTED OIL-EXTENDED RUBBERS

1703 Non-staining. General purpose 25-part naphthenic oil-extended polymer.

1705 Staining. General purpose 25-part aromatic oil-extended, improved processing and aging.

1707 Non-staining. General purpose where higher oil, 37½-part, can be used. Contains rosin acid for extra tack.

1708 Non-staining. 37½-part oil-extended, highly resistant to discoloration and stain.

1710 Staining. Similar to 1705, higher oil level. Easy processing, excellent physicals at lower cost.

1712 Staining. 37½-part oil-extended, superior processing.

4700 Non-staining. 50-part oil-extended, for greatest economy.

Ameripol MICRO-BLACK MASTERBATCH RUBBERS

MICRO-BLACK MASTERBATCH COLD TYPES

1605 Non-staining. Easy processing extrusion polymer with 50 parts of FEF black also suitable for manufacture of high quality molded goods.

1606 (formerly 4659) Staining. 52 parts of HAF black and 10 parts of HA oil. Used sucessfully for retreading.

1608 (formerly 4664) Staining. A quality tread rubber consisting of 52 parts of ISAF black and 12.5 parts of HA oil.

1609 (formerly 4667) Staining. This SAF Micro-Black can be used to an advantage in applications requiring high abrasion resistance; premium quality products can be made from this polymer. Made of 40 parts SAF black and 5 parts HA oil.

1610 (formerly 4660) Staining. 52 parts ISAF black and 10 parts HA oil. High abrasion resistance suitable for tires camelback.

4651 Staining. 62.5 parts of HAF black and 12 parts of HP oil. Used in camelback tires and mechanical goods.

MICRO-BLACK MASTERBATCH COLD, OIL-EXTENDED TYPES

1805 Non-staining. A low cost general purpose rubber of 75 parts HAF black and 37.5 parts N oil.

1808 Staining. This 75 parts HAF black and 50 parts HA oil polymer is very suitable for camelback and low cost molded and extruded goods.

1809 Staining. 75 parts HAF black and 37.5 HA oil. Applications include tires, camelback and mechanical goods.

4756 Staining. Intermediate loading of black and oil produces quality tread stocks. Contains 75 parts HAF black and 37.5 parts A oil.

4758 Staining. A low cost tread rubber consisting of 82.5 parts of ISAF black and 62.5 parts of HA oil.

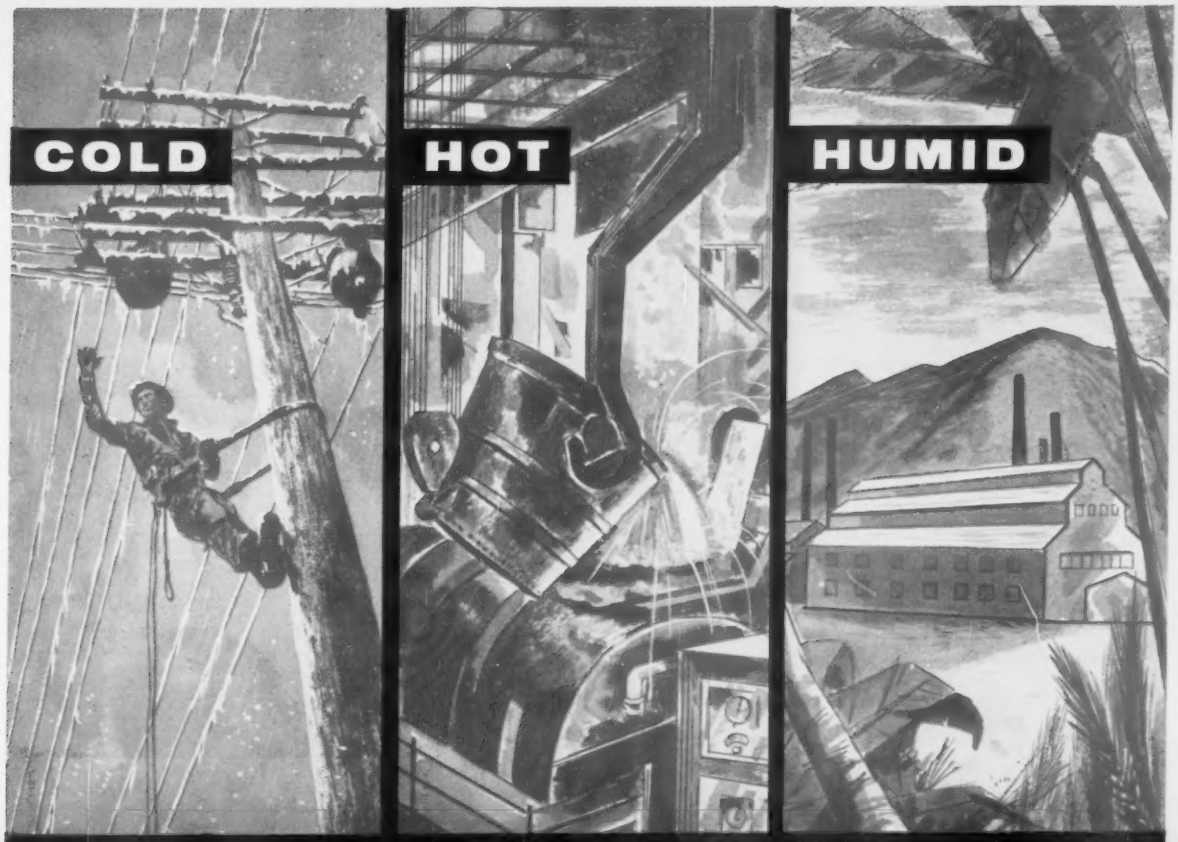
4759 Staining. 75 parts ISAF black and 37.5 parts A oil. Applications include high quality camelback and tires.

4761 Staining. 65 parts SAF black and 37.5 parts A oil. Especially suitable where superior abrasion resistance is needed.

For service in the preferred rubber call...

Goodrich-Gulf Chemicals, Inc.

Cleveland: 1717 East Ninth Street • Phone: TOwer 1-3500
New York: 200 East 42nd Street • Phone: MUrray Hill 7-4255
Chicago: 6272 West North Avenue • Phone: NAtional 2-3722



for electrical insulation that must take it...

MARBON 8000® AE

REINFORCING HIGH-STYRENE RESIN

In frigid northern climate or in the humid tropics . . . for use with hot industrial machinery or with telephone wires . . . electrical insulation compounds, modified with Marbon 8000 AE resin give superior performance.

This hydrocarbon resin also offers proven production advantages: fast, smooth extrusion at lower mixing temperatures, with less scorch . . . good resistance to heat aging . . . high tear and cut resistance . . . low moisture pick up . . . maximum electrical properties and flexibility of compounding with reduced overall cost.

For your next SBR wire insulation compound that must really take it, specify Marbon 8000 AE resin.

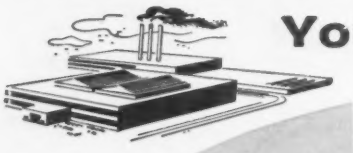
Write Dept. V-3 Today for Complete Information

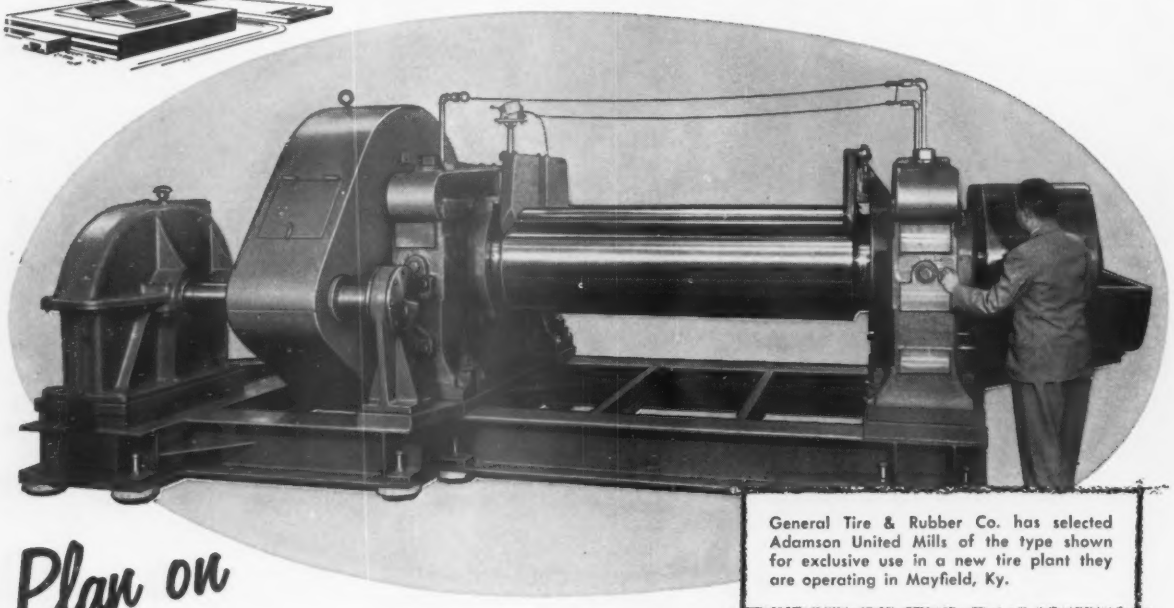
MARBON CHEMICAL WASHINGTON — DIVISION **BORG-WARNER** WEST VIRGINIA

Whether you are planning on

EXPANDING or UPDATING

Your Mill Facilities...





General Tire & Rubber Co. has selected Adamson United Mills of the type shown for exclusive use in a new tire plant they are operating in Mayfield, Ky.

Plan on

ADAMSON UNITED MILLS

for rubber or plastics processing

Yes, whether your plans are for one mill or many, standard or special mills, Adamson United can meet your requirements with mills recognized industry-wide for high production efficiency and trouble-free operation.

Standard units are available in a wide range of sizes from 6" x 16" to 28" x 84", as well as special sizes and types to meet specific requirements. They can be supplied driven individually, in pairs, or in groups on a line shaft. When equipped with leveling-type vibration mounts with fabricated base as illustrated, or with hot-rolled steel plate base, costs of mill installation are substantially reduced . . . on a sturdy floor in good condition, no special foundation is required.

For other new installations Adamson United engineers have drawn on years of experience to produce new simplified mill units which combine only the most desirable design and operational features . . . the result being mills of highest quality offered most economically. Call on Adamson United to help plan **new** installations, or to update existing facilities. We welcome the opportunity to serve you.

7078

Plants at Pittsburgh, Vandergrift, Wilmington, Youngstown, Canton

ADAMSON UNITED COMPANY

730 CARROLL STREET, AKRON 4, OHIO

Subsidiary of
United Engineering and Foundry Company

DESIGNERS AND BUILDERS OF BASIC MACHINERY FOR THE RUBBER, PLASTICS AND PLYWOOD INDUSTRIES

how to vastly increase the useful life of rubber...

Consider the effect of your curing system on the effectiveness of a chemical antiozonant

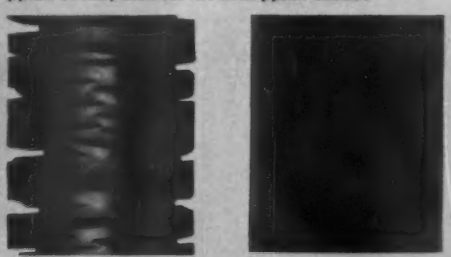
In compounding rubber, use of a potent antiozonant like UOP 88 or 288 is essential in assuring maximum crack-free life. But do you realize what a vast difference may be made by your *curing system?*

Look at the two rubber test strips illustrated. Both were formulated with UOP 88 . . . but note how much more effectively the antiozonant worked when accompanied by this change in curing systems —a vast increase in resistance to cracking!

Help in achieving maximum effectiveness from UOP 88 or 288 antiozonants is available through UOP facilities and technical personnel. Just write or telephone our Products Department.

UOP ozone cabinets provide test conditions at a wide range of ozone concentrations.

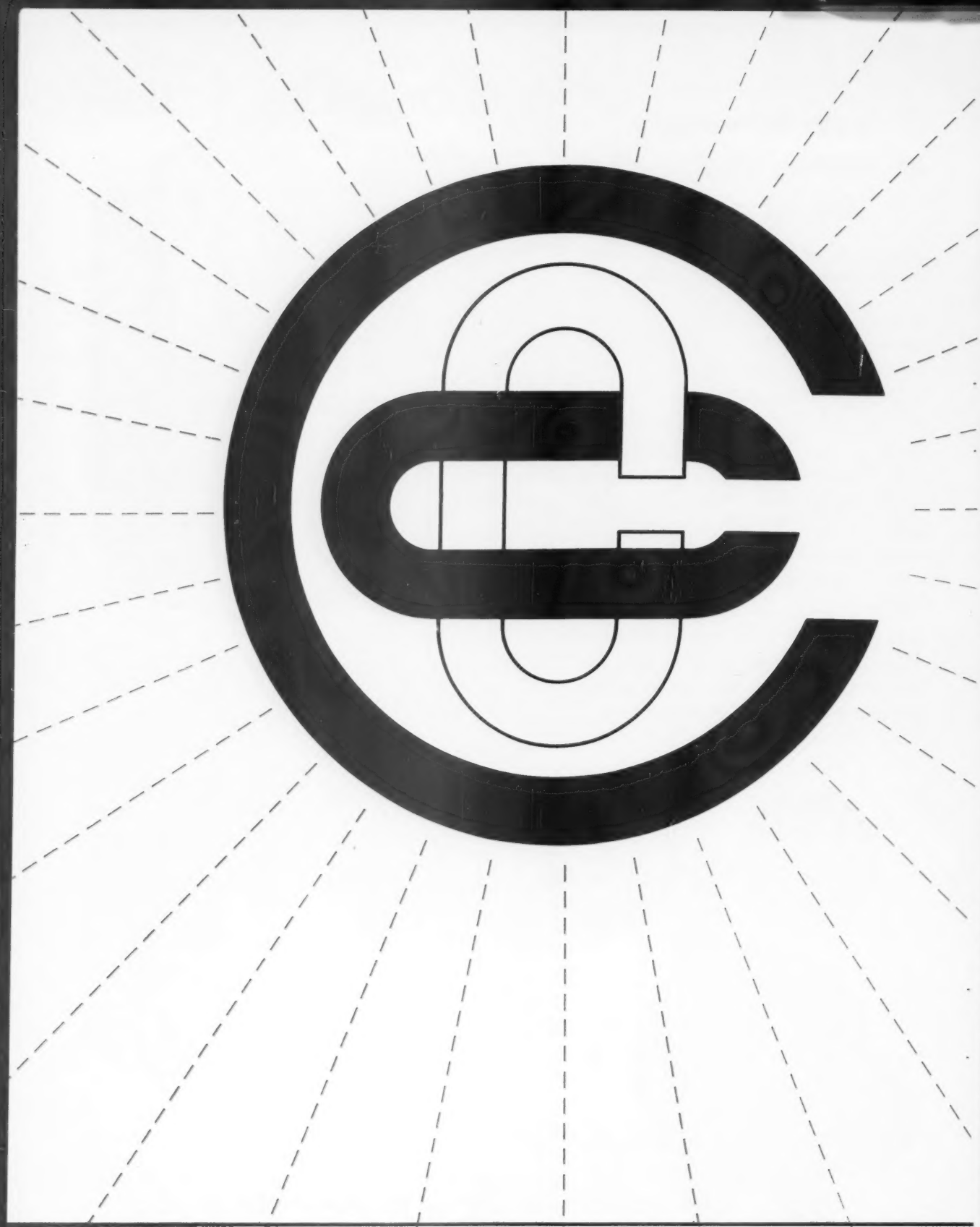
The SBR specimens below were exposed to ozone at 100°F with 20 percent elongation for 52 hr. at 33 pphm ozone, then 187 hr. at 63 pphm ozone.



Carbon black—HAF (high abrasion furnace), Curing system—4 phr tetramethylthiuram disulfide; Hours to first crack—7 to 23.

Carbon black—HAF (high abrasion furnace), Curing system—2 phr sulfur, 1 phr N-cyclohexyl-2-benzothiazole sulfenamide. No cracks in 239 hr.

UOP
UNIVERSAL OIL PRODUCTS COMPANY
30 Algonquin Road, Des Plaines, Illinois, U. S. A.
WHERE RESEARCH TODAY MEANS PROGRESS TOMORROW



U. S. A. . . .
COLUMBIAN CARBON COMPANY
International . . .
COLUMBIAN CARBON INTERNATIONAL, INC.

APRIL, 1958

Companhia Petroquimica Brasileira (Copebras)
Commercial production begins in Brazil.

JUNE, 1960

Continental-Columbian Carbon Nederland N. V.
Commercial production begins in the Netherlands.

OCTOBER, 1960

Columcarb AG
European Sales and Technical Service office opens in Zug, Switzerland.

Now...a new symbol of COLUMBIAN CARBON COMPANY on the move...around the world

Around the world, Columbian Carbon Company is more than ever on the move. And Columbian's new trademark is the mark of leadership! Wherever you are . . . whatever your needs . . . there is a Columbian representative near you . . . equipped to handle your toughest production or supply problem. Call him . . . today!

OUTSTANDING RESEARCH

Columbian has long been the industry leader in research. In the quest for blacks that meet the most exacting requirements, Columbian was the first to discover the importance of pH in curing characteristics . . . first to use electron microscopy to measure particle size . . . first to develop a dispersant free Black Rubber process. And Columbian *continues* to spearhead the research that means better, more versatile, more economical rubber products.

OUTSTANDING PRODUCTION

Product performance is the proof that Columbian has the precise production controls that deliver blacks to match your most rigid requirements. Columbian is going literally around the world to meet the demand for carbon blacks with unexcelled performance.

OUTSTANDING TECHNICAL SERVICE

Columbian is noted for Technical Service. It's always available to you . . . to analyze any aspect of your production . . . offer practicable ideas for greater economy and efficiency. Contact your Columbian representative for information about the Technical Service Laboratory nearest you.

DECEMBER, 1960

Columbian Carbon Italiana S.p.A.

Columbian opens another overseas Sales and Technical Service office in Milan, Italy bringing the total to seven overseas sales offices and agents in 40 countries.

MARCH, 1961

Columbian Continental Europa S.p.A.

Commercial production begins in Milan, Italy.

MARCH, 1961

Mitsubishi Chemical Industries, Ltd.

Commercial production begins under license from Columbian Carbon Company.

SPRING, 1961

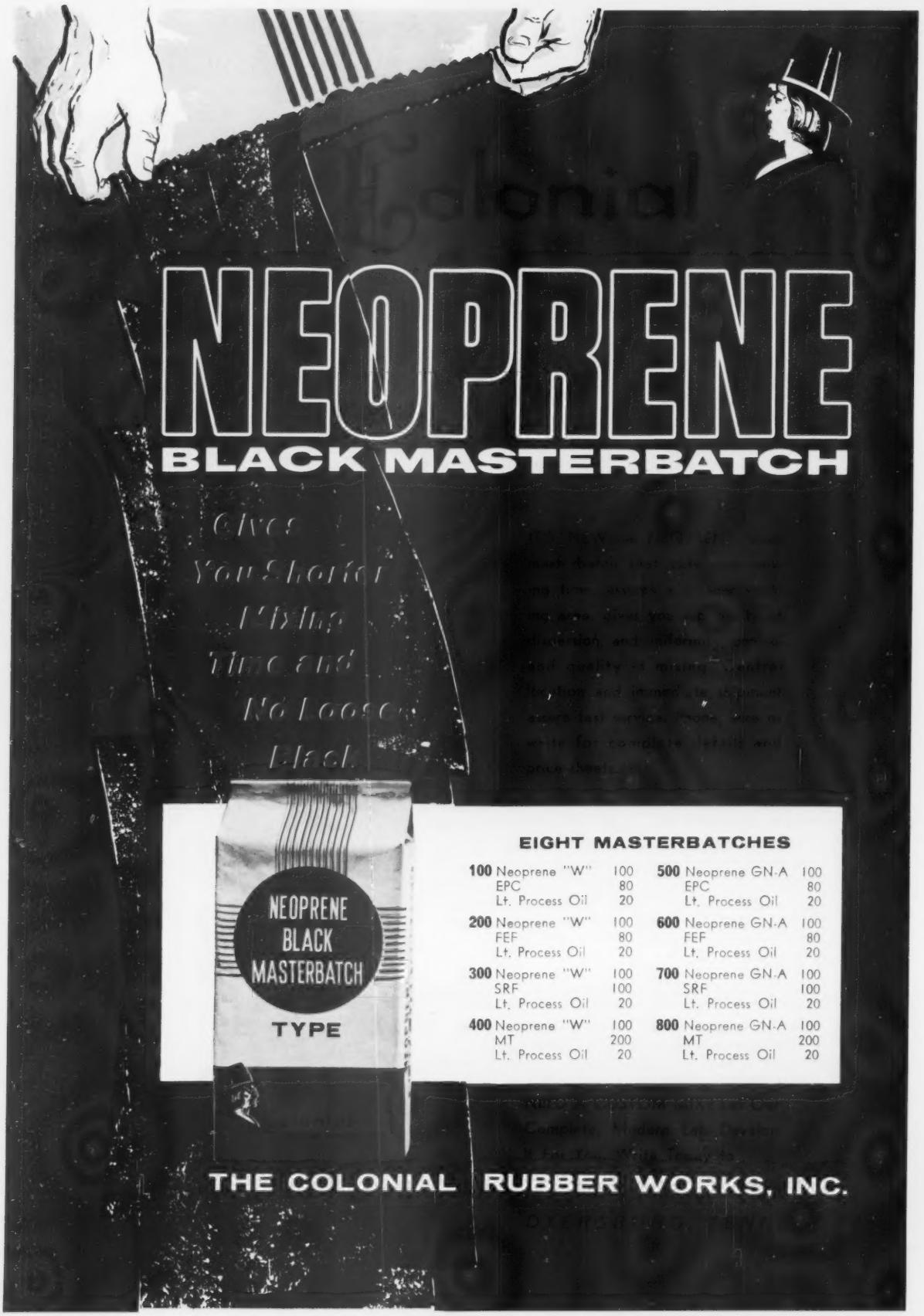
Columbian Carbon Company

New Carbon Black Dispersions Plant begins production in Deer Park, Texas.

SUMMER, 1961

Columbian Carbon (Canada) Ltd.

Commercial production begins in Hamilton, Ontario, Canada.



EIGHT MASTERBATCHES

100	Neoprene "W"	100	**500**	Neoprene GN-A	100
	EPC	80		EPC	80
	Lt. Process Oil	20		Lt. Process Oil	20
200	Neoprene "W"	100	**600**	Neoprene GN-A	100
	FEF	80		FEF	80
	Lt. Process Oil	20		Lt. Process Oil	20
300	Neoprene "W"	100	**700**	Neoprene GN-A	100
	SRF	100		SRF	100
	Lt. Process Oil	20		Lt. Process Oil	20
400	Neoprene "W"	100	**800**	Neoprene GN-A	100
	MT	200		MT	200
	Lt. Process Oil	20		Lt. Process Oil	20

THE COLONIAL RUBBER WORKS, INC.

As Ken Soule Sees It

by Kenneth J. Soule

Tonsorial Note

Men—is your hair-line receding? Does your pink scalp begin to peek through what used to be a thick, luxurious mane of hair? In a word, do you show signs of impending baldness?

If the answer is a sad-faced "yes," take heart. A Stockholm surgeon, Dr. Olaf Smith, is reported by the daily press to have developed a hair-rising solution to your tragic dilemma. It is shockingly simple, involving merely the partial loosening of the skin on the skull, in order to let the repressed hair come through. Sort of a modified scalping operation.

If perchance the plan were to catch on, and thousands of shining, male domes were once more covered with heavy masses of resplendent hair, what a glorious day that would be! Barbers everywhere would rejoice. Wives would be in their glory at once more being able to get a good hold of fleeting husbands. Of course, the newly-thatched men would also be covered with happiness- as well as skull-protecting hair. Dr. Smith might achieve a "No-Bull" Prize—perhaps even a massive marble bust, with small figures in bas-relief, of Geronimo, Crazy Horse, Hitchcock, and Karloff—earlier practitioners of this noble hair-raising art.

Fresh Water

One of the major problems presented by the current industrial expansion and "population explosion" is the urgent need for greatly increased supplies of fresh water at reasonable prices. The U.S. Goedetic Survey reports that at the moment, the total available water supply in the United States is 515 billion gallons daily, and our average total consumption, 312 billion gallons per day! However, even now in seasons of low rainfall, local water shortages are matters of painful memory. And when it is considered that in 20 years our daily water consumption will reach, conservatively, at least 600 billion gallons of water per day, the need for strenuous efforts in all directions, to augment as well as to conserve supplies, becomes imperative!

Since most of our presently available water depends primarily on rainfall, conservation efforts include proper methods of reforestation and of grass lands control to help prevent excessive run-off and top-soil erosion. Dams and levies serve a similar purpose, while reservoirs add to natural storage areas and serve to stabilize the supply situation.

In this connection, a novel method of reducing evaporation from lakes and reservoirs was outlined in a paper by Senator James E. Murray at the fall A.C.S. meeting in New York City. As reported in *Chemical and Engineering News,* the address was read by Eugene D. Eaton, consultant to the Senate Committee on "Interior and Insular Affairs." The chemical method described consists of blowing dry, powdered cetyl alcohol over the surface of the water from a motor boat as it cruises slowly over the area. The fine powder settles on the water surface and quickly spreads to form a continuous monolayer. Wind and waves break up the film somewhat, but it mends itself when the water becomes quiet. Such films, when applied carefully and serviced daily, are said to cut evaporation losses by at least 30 per cent.

Another interesting method to prevent losses of water in transit involves the use of a thin, tough plastic film to line the canals and ditches leading water to irrigated fields. It is claimed that seepage is completely eliminated and that water costs, therefore, are greatly reduced.

Fresh Water From the Sea

The other major aspect of the water supply problem involves efforts to provide new sources of usable water. Because of the vast volume of water needed, the only available source of raw material seems to be the ocean itself. There is no problem in getting fresh water from saline water—this can be done by any one of several well-known methods, such as distillation, filtration, or freezing. The unresolved question is how to do it at a reasonable cost. Both the U.S. Government and private industry, individually and cooperatively, have been studying this matter rigorously for a number of years.

As these studies develop sufficient information to justify it, the government authorizes the building of a large scale plant to check still further the practicability of the chosen method. Groundbreaking for the first such installation took place August 30, 1960, in Freeport, Texas. Here the Department of Interior, (Office of Saline Water Division), began building a plant with a planned capacity of 1 million gallons of fresh water per day. The method used is a special type of distillation—using what is known as a 12-effect evaporator. It is expected that the water produced will cost approximately $1 per 100 gallons, and that later on this could be reduced to an acceptable figure of about 35 cents by increasing the plant capacity ten-fold.

The O.S.W. is planning a number of other demonstration plants in various parts of the country. Where they will be built, and what processes will be involved, depends on the results of the extensive work now under way. One thing, however, seems absolutely certain. Before the water crisis becomes

critical, practical methods will have been completely worked out for removing the salt from sea water, and plants will have been built to produce enough fresh water to supply all of the country's needs. You can bet on this!

Fish and Fishing

One of the most recent attempts to prove that men are smarter than fish is represented by U.S. Patent No. 2,965,996. This was issued late in 1960, and covers a magnetic fish lure. It was awarded to Lieut. Col. Frederick E. Hughes, a Marine aviator who holds the Distinguished Flying Cross and the Air Medal with eight gold stars, representing forty-five combat missions. For the past year, he has been in Okinawa with the First Marine Aircraft Wing, but is presently slated to report for duty in Hawaii.

Colonel Hughes is also an inventor and, obviously, a fishing enthusiast. His latest fish lure, as described by Stacy V. Jones in the *New York Times,* is essentially a flat plate with a rounded leading edge. In general appearance it somewhat resembles a miniscule PT boat, and carries a built-in permanent magnet. In use, when the fisherman casts and then allows his line to go slack, the lure automatically turns in the water, due to the action of the magnet aligning itself with the earth's magnetic poles. The resulting quiver, twitch or wiggle is supposed to be most alluring to any nearby fish. An added feature permits the user to adjust the angle of the magnet, depending on the direction of the shore line being fished, to get maximum co-operation between the gadget's magnet and the earth's magnetism.

It sounds as though a well thought-out, scientific device of this kind could hardly fail to lure fish and fishermen alike. However, at the moment, the device is not yet on the market, so the next best thing for ardent anglers would be to try another Hughes invention. This would be a "bug-eyed lure," now in the stores, or perhaps a metal wiggler, patented some time ago. These should hold you until the Colonel arranges to make his latest rubber or plastic wiggler available "in the flesh."

A Unique Building Aid

The concrete block industry now has a new and spectacular weapon in its arsenal. This is the recently-announced Raybestos-Manhattan Threadline mortar, which permits construction of joints that are stronger than the concrete blocks themselves. An added advantage of the new mortar is that lay-ups can be finished in about one-third the time formerly required.

The Threadline mortar (patent pending) is put up in a small package consisting of four plastic envelopes, two containing powders and two liquids. These are to be carefully mixed together, in a pail or other simple container following a prescribed method. This can be done by hand, or with a small electric mixer. Time required 3 to 4 minutes. The resultant mixture, (enough to bond 100 blocks), is then placed in a caulking gun, or similar device, and finally extruded in a narrow ribbon on the surfaces to be bonded. Since these ribbons produce a finished joint about 1/16″ thick, the concrete blocks, bricks, or other masonry units must be pre-ground to exact dimensions. While the mortar is twice as expensive as the old type, the speed with which it can be applied, and the simple equipment needed, make it much cheaper in actual use. Another plus is the fact that it can be applied at temperatures about 10°F. lower than heretofore; thus, the working season can be extended.

All in all, it would seem that Threadline mortar should fill a lot of long-felt needs in the building game. It is claimed that it is being exceptionally well received by masons and contractors, since its time and labor-saving features enable them to be newly competitive with other forms of construction.

As for do-it-yourselfers, they should be very happy with the ease of handling and the low cost attributes. Within five minutes after laying out a job, you can actually start to build a wall or even your own stately mansion of brick or concrete! *Life,* prophetically perhaps, calls it "A new and mighty Mortar."

Technicolor Tires

Standard automobile tires, in general, are so well made and give such excellent service that they are almost completely taken for granted. Thus, ordinarily they are not particularly newsworthy. Specialty or test tires on the contrary, sometimes make headlines or possess intriguing features.

One such illustration is the translucent, experimental tire recently road tested by Goodyear. It is unique in a number of ways: (1) it can be produced in a wide variety of bright colors; (2) it contains no cord or fabric reinforcement; and (3) it can be made to glow beautifully at night by means of lights used inside the casing!

The tire is made of polyurethane rubber (Neothane), and since it contains no fabric inserts it can be produced by pouring the rubber directly into the mold, instead of in the conventional manner. This simplification should help eventually in reducing costs, although the present high charge for the specialty rubber would keep the finished tire price high.

Polyurethane inherently has exceptional wear resistance, but the tire as presently designed would not be practical because of premature sidewall breakdown. Design modification compounding changes no doubt can correct this weakness, as well as the poor traction properties shown at present.

At the moment, this technicolor triumph has made headlines in newspapers, plush periodicals including Life, and technical journals such as *Chemical and Engineering News.* It has even stirred Eugenia Sheppard, women's feature editor, N. Y. Herald Tribune to comment: "Colored tires are on the way, according to Goodyear. They will come in all the eye and dress colors! Picture the barrage of colors on the parkway, picture the girl who can't make up her mind, and dresses all four wheels in different shades."

MORE GOOD NEWS ABOUT
SYNPOL
...IN COATING AND FLOORING
TEXUS

Used for a wide variety of coated fabrics, SYNPOL gives this sleeping bag softness and flexibility, protects against soil and moisture, insulates against cold weather.

Lightweight and capacious describes modern VAL-A-PAK® luggage of SYNPOL-backed nylon fabric for smart and lasting protection of clothing against dirt, dust and inclement weather. SYNPOL gives just the degree of flexibility required, provides a durable, non-staining interior surface to make this luggage so highly practical.

All coated fabrics described processed by **Aldan Rubber Co.**, Philadelphia.

The rugged, warm DUXBAK® hunting coat is lightweight, yet highly waterproof and windproof. A SYNPOL rubber resin lines and bloodproofs this jacket's expanding game pocket. SYNPOL guards against moisture, is permanently flexible.

New, fast pastel colors is the powerful sales secret of American Rubber Sales Company's line of marbleized and flecked terrazzo pattern rubber floor tile. SYNPOL offers such remarkable color characteristics that users can now enjoy all the resilience, durability, and economy for which rubber tile is outstanding, with truly superior color effects.

TEXUS

SYNPOL®

Consider the "good news" possibilities SYNPOL SBR Rubbers offer your product... present or proposed. Choose from the widest line of SBRs in the industry. Enjoy the product and processing advantages resulting from unusually rigorous quality controls. Discover the difference a SYNPOL can make.

Among the 30 SYNPOLS that can save you money and boost your product performance in these and other applications are:

SYNPOL	HOT TYPES			COLD	OIL-EXTENDED
	1001	1013	1061	1502	8200
DESCRIPTION					
Emulsifier	Fatty Acid	Fatty Acid	Fatty Acid	Mixed Acid	Fatty Acid
Stabilizer	Slightly Staining	Non-Staining Non-Discoloring	Non-Staining Non-Discoloring	Non-Staining Non-Discoloring	Non-Staining Non-Discoloring
Coagulant	Salt Acid	Alum	Salt Acid	Salt Acid	Glue Acid
Polymer					Polymer—100 pts.
Oil					NAPH—37.5 pts.
PROPERTIES					
CHEMICAL	Specifications	Specifications	Specifications	Specifications	Tentative Specifications
Volatile Matter % wt.	0.50 (Max.)	1.00 (Max.)	0.50 (Max.)	0.75 (Max.)	0.75 (Max.)
Ash % wt.	1.50 (Max.)	1.25 (Max.)	1.50 (Max.)	1.50 (Max.)	0.50 (Max.)
Organic Acid % wt.	4.00—6.25	4.00—6.00	4.00—6.50	4.75—7.00	3.90—5.70
Soap % wt.	0.75 (Max.)	0.01 (Max.)	0.75 (Max.)	0.50 (Max.)	0.50 (Max.)
Bound Styrene % wt.	22.5—24.5	42.0—44.0	22.5—24.5	22.5—24.5	22.5—24.5
Stabilizer % wt.	1.00—1.75	1.25 added	1.25 added	1.25 added	1.25 added†
PHYSICAL	Specifications	Specifications	Specifications	Specifications	Typical Production Values
Specific Gravity	0.935	0.965	0.935	0.935	0.925
Raw Viscosity, ML-4′—212° F.	44—52	40—50	44—52	46—58	56
Cpd. Viscosity, ML-4′—212° F.	73 (Max.)	73 (Max.)	73 (Max.)	73 (Max.)	52
Tensile psi 50′	2500 (Min.)	2500 (Min.)	2500 (Min.)	3100 (Min.)	3110
Elongation % 50′	500 (Min.)	600 (Min.)	500 (Min.)	575 (Min.)	740
Modulus psi 25′ } 300% Elongation	325—625	350—750	325—625	350—650	390
Modulus psi 50′ } 300% Elongation	750—1100	775—1175	750—1100	700—1150	650
Modulus psi 100′ } 300% Elongation	1200—1600	1250—1750	1200—1600	1150—1650	920
Water Soluble Ash % wt.					0.35
Water Absorption mg./sq. cm.					0.78
TEST RECIPES[1]					
Polymer or Masterbatch	100.00	100.00	100.00	100.00	100.00
EPC Black	40.00	40.00	40.00	40.00	40.00
Zinc Oxide	5.00	5.00	5.00	5.00	5.00
Sulfur	2.00	2.00	2.00	2.00	1.75
Benzothiazyldisulfide	1.75	1.75	1.75	2.00	1.75
Stearic Acid		1.50			
REMARKS	General purpose hot rubber which is more resistant to staining and discoloring than 1000.	A high-styrene SBR, non-staining & non-discoloring, having reduced water soluble ash, low water absorption & excellent flow properties.	A non-staining non-discoloring polymer stabilized for maximum resistance to breakdown and gel formation during milling.	Non-discoloring and non-staining cold rubber. Higher physicals than 1006 and 1061.	An oil-extended polymer especially designed to give extremely high resistance to discoloration & staining. Low ash and low moisture absorption properties.
APPLICATIONS	Tires, molded and extruded mechanical goods, shoe soles & heels.	Calendered goods, closures, can sealants, adhesives and molded goods. Designed for applications requiring high green strength and excellent flow characteristics.	Light-colored & white products such as white sidewall tires, shoe soles, floor tile, toys, hospital sheeting, sporting goods, high-impact styrene.	Light-colored & white products such as white sidewalls, light mechanicals, floor tile, hospital sheeting, toys, soles, heels, food conveyor belts, high-impact styrene.	For use in light and bright colored products requiring outstanding sunlight resistance. Low ash content makes it particularly well suited for low-moisture absorption applications.

[1]The figures given are parts by weight of NBS Standard Compounding Ingredients. Press cure at 292° F.

†Based on non-extended polymer

VISIT OUR HOSPITALITY ROOM
Division of Rubber Chemistry
A.C.S. Convention
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MUrray 8-7764

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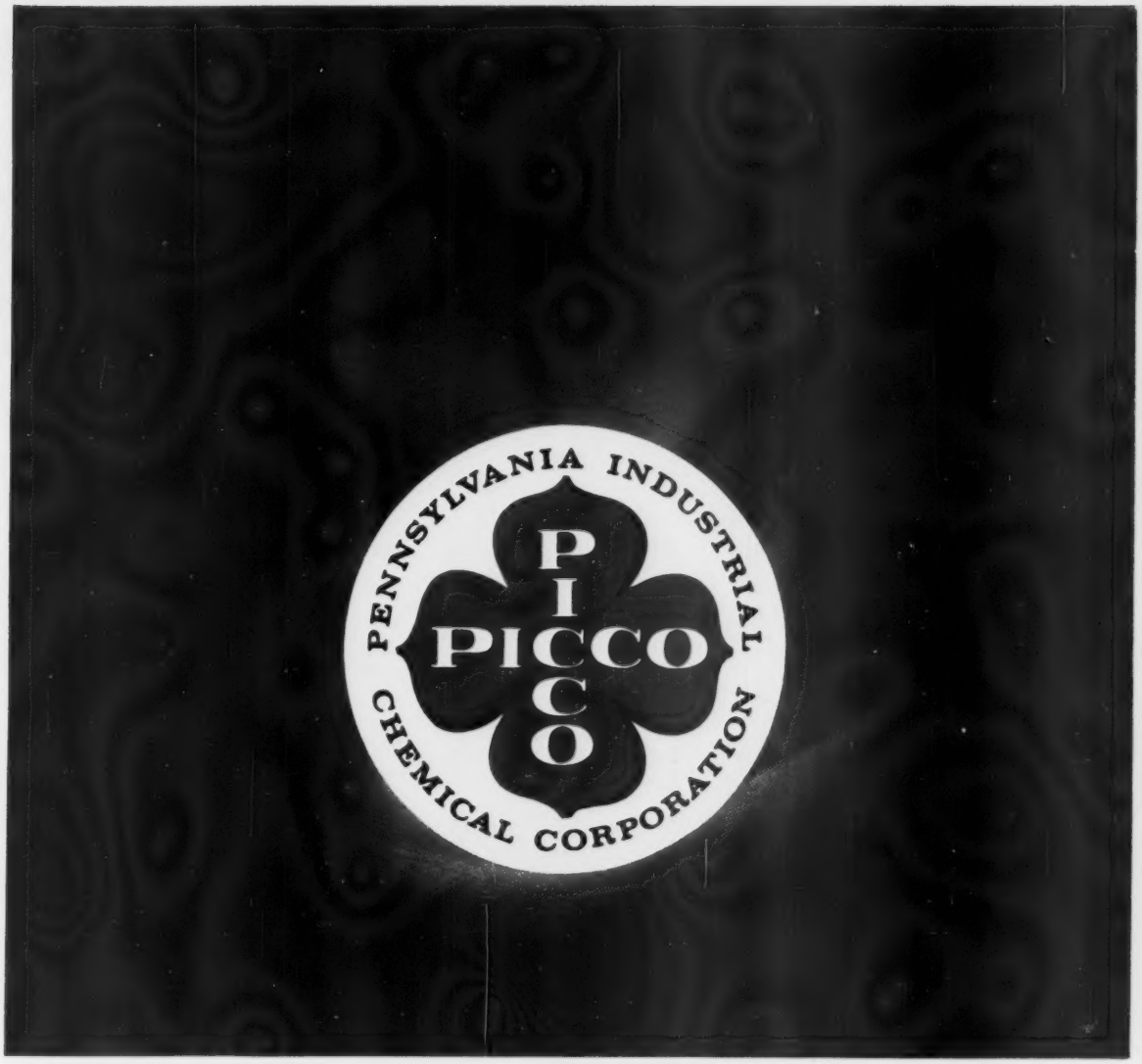

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Picco Resins

You can specify Picco Resins with absolute confidence in the high quality of these fine hydrocarbon products. Carefully manufactured under rigidly controlled conditions in large quantities, their consistent uniformity assures trouble-free operation. Picco Resins are neutral thermoplastics, and are resistant to alkalies, salts and dilute acids. Their wide spectrum of utility is accentuated by stability and inertness.

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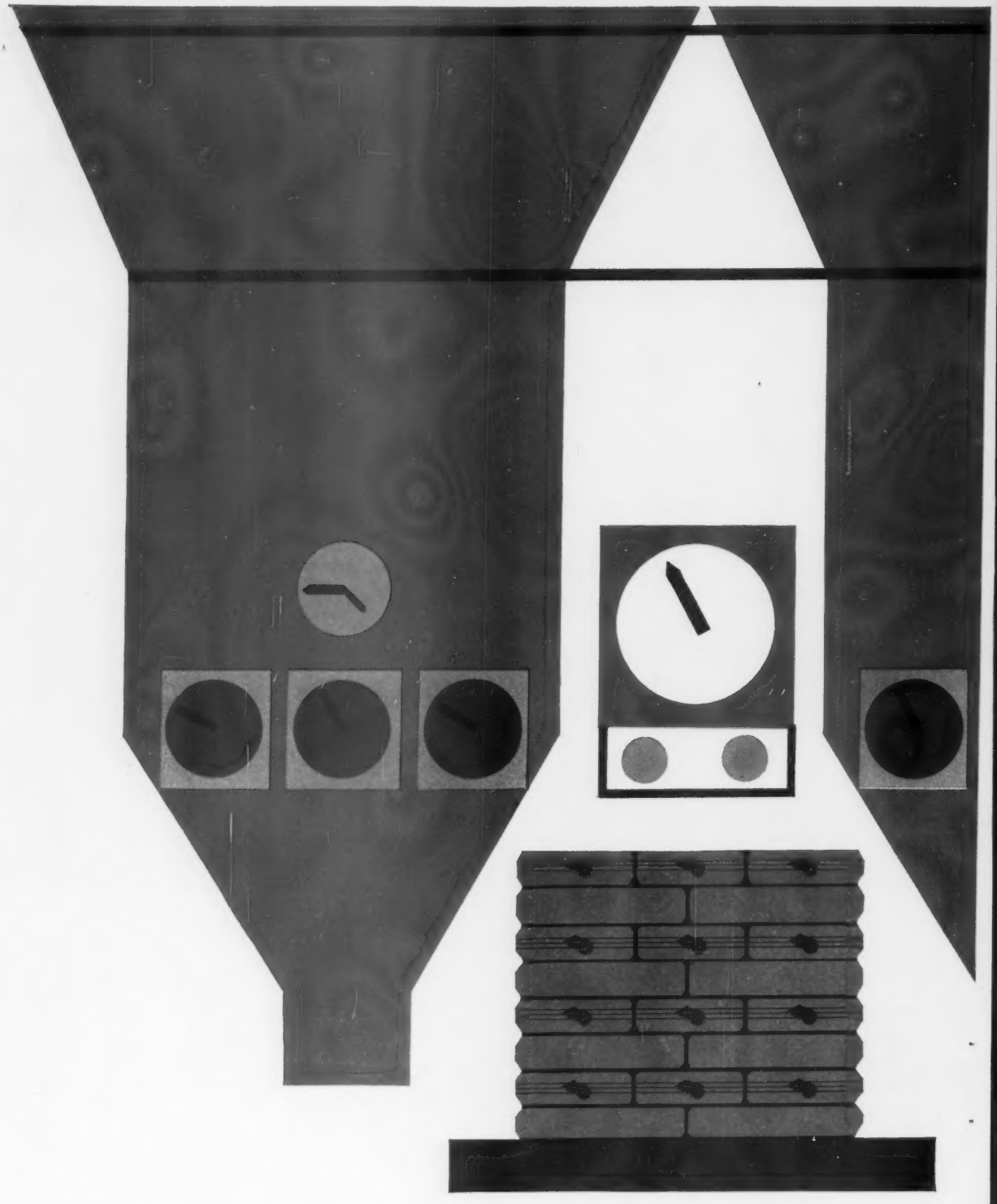

We hope to see you at the
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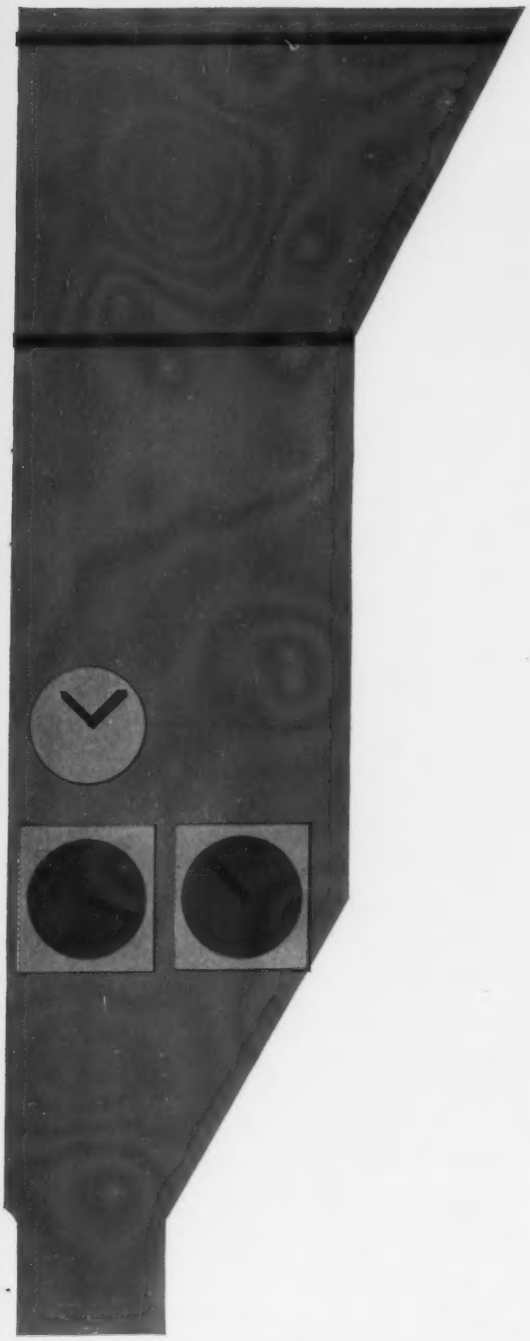

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Continuous production in the industry's most heavily instrumented plants means you get carbon black of consistent quality when you order it from Witco-Continental. You get a product with the physical properties you want, shipped the way you want it.

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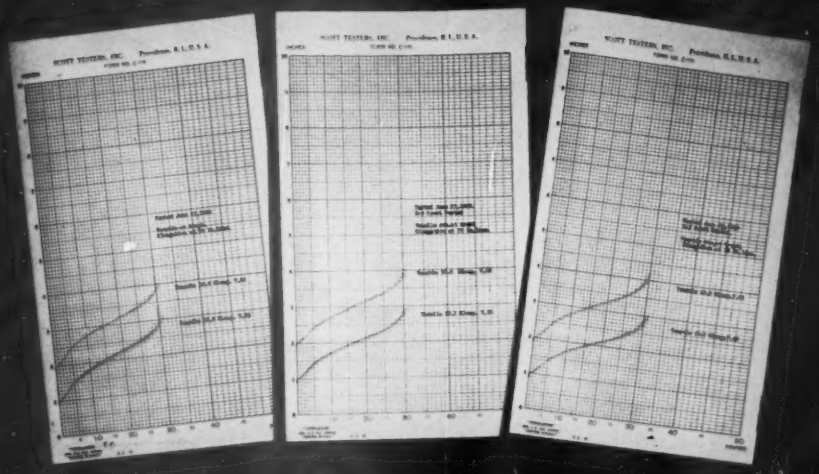
REPORT CARDS FOR THE WORLD'S MOST MODERN TIRE CORD PROCESSING INSTALLATION



Top grades are being assigned to the tire cord produced on the Armstrong Tire & Rubber Company's triple-zone rayon/nylon processing line which went into production a year ago at Des Moines.

Tensile strength of the tire cord consistently hovers within a few tenths of a pound around the 31 psi mark, and elongations achieved are exactly those specified for maximum tire life.

These results are attained day in and day out, without the need for time-consuming experimentation and adjustment. They are likewise consistent across the whole face of the fabric, with maximum tensile variation of a fraction of 1% at any point in the web width.

This Litzler designed and constructed line has the best of "attendance" records, too. From the time of startup, two weeks after installation completion, the line has been running at rated capacity with negligible maintenance.

For consistent, top results in tire cord processing: for the most productive designs in the world . . . for the most reliable engineering in this specialized field . . . consult the engineers of the

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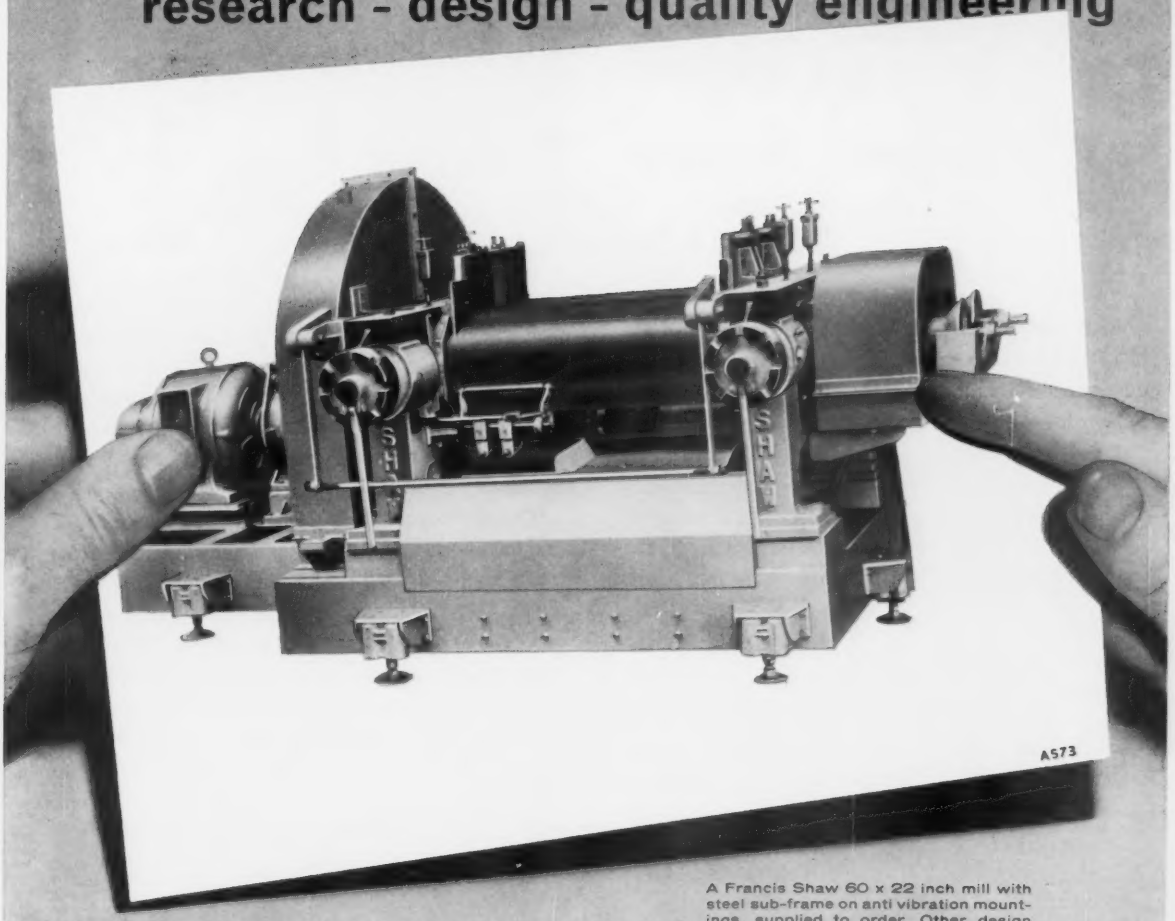

A Francis Shaw 60 x 22 inch mill with steel sub-frame on anti vibration mountings, supplied to order. Other design features available include:

* Power operated nip adjustment
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OVERSEAS AGENTS THROUGHOUT THE WORLD

P435i

As the technology of an industry extends to new and more complex strata, the simplicity of product origination, purpose and progress is sometimes obscured. Putting a product in perspective can be a refresher for the experts and an historical guide for the newer members of the rubber and carbon black industries.

Dr. Isaac Drogin
A 39 Year Student of Carbon Black
United Carbon Company

A Product in Perspective

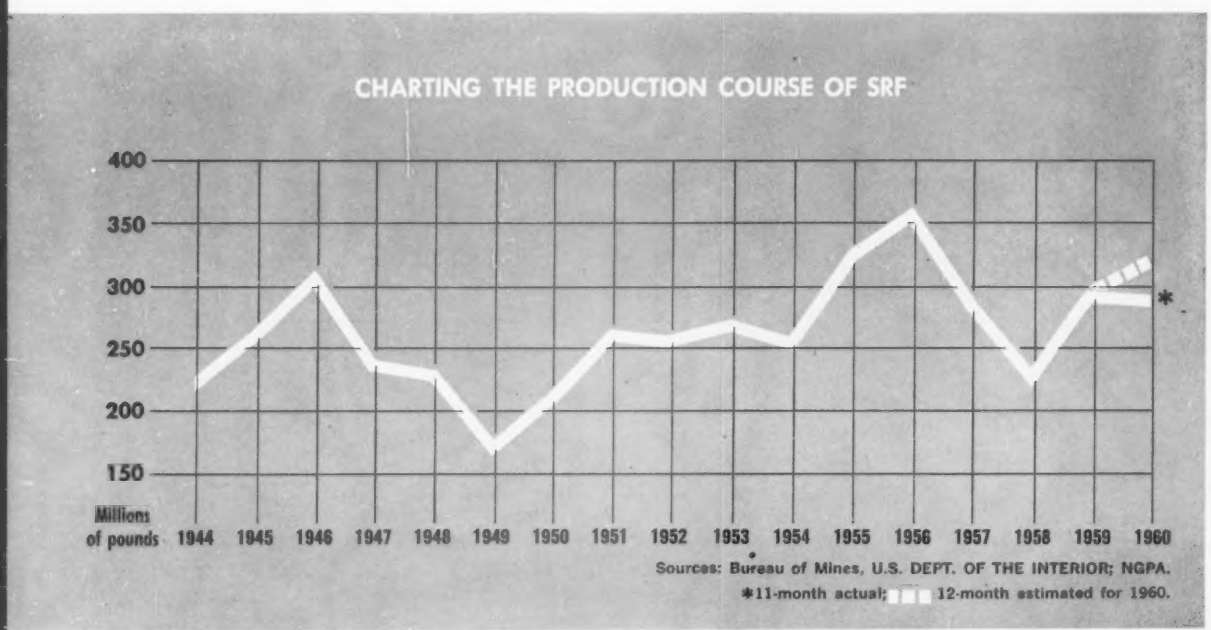
SRF Carbon Black

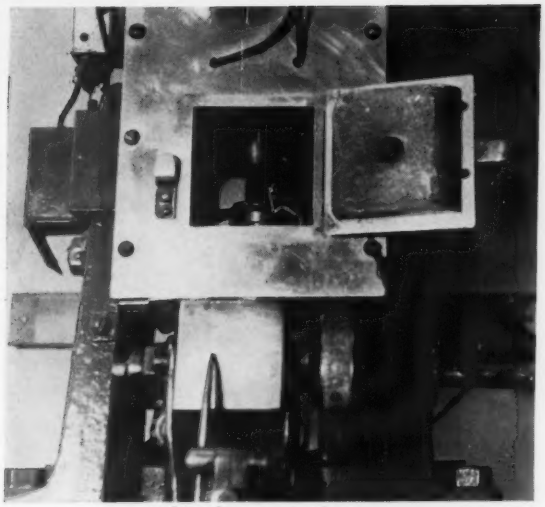
SRF carbon black or Semi-Reinforcing Furnace black produced from natural gas, oil-enriched gas or oil alone survives today—some thirty-eight years after its introduction—because its functional performance has not been duplicated or exceeded by any other material. Taking this glib phrase apart from the viewpoint of the purchasing agent, the production superintendent, the compounder and the ultimate user, the nature and purpose of SRF can be brought into focus.

The Search

As in so many industries, the forces which brought about the development of the first furnace black—now designated as SRF—were twofold: property and productivity impasses. This simple statement of fact is found in an early patent covering a furnace process. "The principal object . . . is to obtain a largely increased yield of good quality black from a given amount of hydrocarbons."

The commercial yield of the largest black production technique in use at the time, the channel process, was about 4-6 per cent of the available carbon in the gas. The products produced by the channel process can be characterized as small in particle size, capable of imparting excellent rubber physical properties and exhibiting very high color values. Supplies of low





Taking heat generation measurements on an SRF rubber compound.

price natural gas were suspect and the handwriting was on the wall—increase the yield or lose out on the economy front.

Early Results

Thermal blacks were the first results of the industry's research efforts. Here the yield was increased to approximately 25 per cent. On the other hand, particle size was also increased to fifteen times the size of channel black and the color value of thermal black was only 25 to 35 per cent on a comparative basis. (Color or tint values are included in these characterizations of SRF because they were, and still are, good general indicators of the type of reinforcement that can be expected from a product. Early patents usually included reference to this property.)

In 1922, a patent application by Chauncey Matlock introduced the continuous combustion furnace process. In 1933, General Atlas Carbon Company received a patent for a more refined process that resulted in an established commercial product. Yield was 25 to 35 per cent of available carbon; and color value, while not as strong as that of channel black, was 45 to 60 per cent, which is considerably higher than that of thermal black.

Other Plus Features

From a manufacturing cost standpoint several improvements were also accomplished by the development of thermal and furnace black production systems. Both systems required less equipment and less plant area; reduced air pollution; lowered maintenance; and provided greater production quality control. This control was possible because the channel process is open or exposed whereas the newer furnace processes are completely closed.

Significant Properties

The significant property differences between channel, furnace and thermal blacks were to allow even broader market and application diversification for black. To visualize this situation, it would be good to review some of the important functions of carbon black in relation to SRF. Briefly stated they are as follows:

1. Reinforcement (wear and service life)
2. Filler (economy)
3. Processing Aid (mixing and fabrication)

In comparative terms SRF is unmatched as an economical, high loading, and strengthening agent for rubber stocks. Breaking this down for further characterization, it can be noted that SRF allows a compounder to increase his loading of black per pound

Determining the resiliency of an SRF rubber compound.

of rubber and still achieve a medium hard, good flexing stock. Similar loading of channel black would make a non-flexible end product with extremely difficult mixing and processing features. Thermal black on the other hand, with its considerably larger particle size, offers greatly increased flexibility but is severely curtailed in reinforcing attributes. Thus, thermal black must be reduced to applications requiring great flexibility at the sacrifice of reinforcement.

Processing Advantages

From a processing standpoint, the softer and more resilient SRF black mixes coolly and easily with the rubber stock even at high loadings. Therefore, scorch problems are minimized and the addition of curatives at any early stage is practical. Further, in uncured stock, SRF has the necessary green strength for slabbing, for holding the full body during tubing and for minimizing any sagging of the rubber during open heat cures.

SRF carbon black has found use in every type of man-made and natural rubber. Its easier mixing and processing has made it especially useful in the nitrile, polysulfide and chloroprene rubbers and it undoubtedly will find an important role in the new rubber copolymers and terpolymers.

Product Uniformity and Performance

At least three patented furnace designs are used in the production of SRF black. Properties will tend to vary according to the nature of different feed stocks (gas and/or oil), their ratios, volume of air intake, furnace temperature gradients, cooling and collection and processing techniques, and the furnace design itself.

If you have a particular question relating to SRF or any other carbon black manufactured by United Carbon Company, please write to Dept. RA-3, United Carbon Company, Inc., 410 Park Avenue, New York 22, N. Y.

PROPERTIES OF SRF IN REVIEW

PROPERTIES*	UNITS	MT	SRF	FEF
Surface Area	Sq. M/Gm.	6.6	19.5	39.0
Particle Dia.	Mu	473.0	160.0	80.0
Volatile Matter	%	0.96	0.74	0.91
PH	—	7.4	9.9	9.3
Iodine Number	Mg./Gm.	8.5	21.1	47.0
Tint Comparison	—	100.	240.	308.

**Property values are based on United Carbon and/or ASTM test procedures.*

This property chart can illustrate in broad comparisons the difference between MT, SRF and the true carbon black processing aid FEF. Note the tint increase as particle size decreases.

COPOLYMER LATEX

COPO 2000 — A medium solids "hot" latex having a high bound styrene content which gives excellent film strength and adhesive qualities. Used in cord dipping, rug backing and other textile treating applications.

COPO 2101 — A low solids "cold" latex for general purpose use. Excellent for tire cord dip.

COPO 2102 — This high solids "cold" latex has a low bound styrene content but has the highest rubber hydrocarbon content of all cold latices in production. Used primarily in the manufacture of latex foam sponge and is especially applicable where low temperature flexibility is the governing factor.

COPO 2105 — This latex has an excellent wet gel (uncured film strength). COPO 2105 is used extensively for foam sponge, carpet backing, adhesives, and a general purpose high-strength latex.

COPO 2108 — A medium solids version of COPO 2101.

COPO 2110 — This high solids "cold" latex has excellent properties for the manufacture of foam rubber and is also recommended for backings and adhesives and as a general purpose high-strength latex.

COPO 3852 — This latex is used with very good economy for rug and textile backing, adhesives, and as a general purpose high strength latex. COPO 3852 is a medium high solids "cold" latex.

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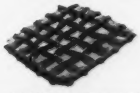
FOAM

COPO 2102
COPO 2105
COPO 2110

TEXTILE TREATING



COPO 2000
COPO 2108
COPO 3852

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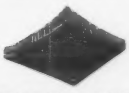

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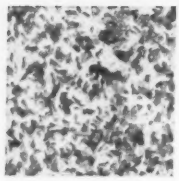

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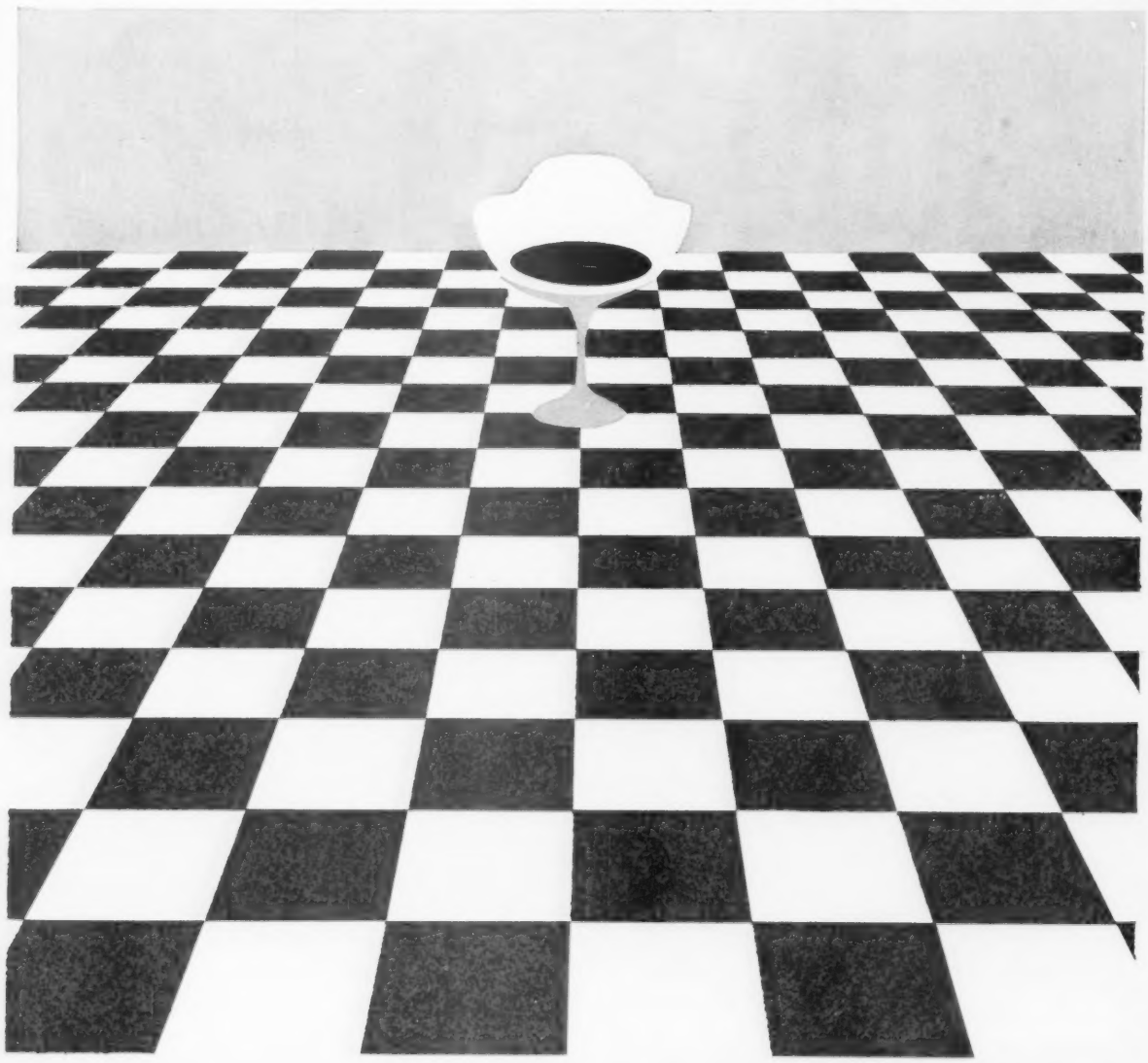

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1. Volatile Matter	—	0.75%	0.25%	3-6
2. Total Ash	—	0.35%	0.20%	11-15
3. Organic Acid (Stearic)	4.75%	6.75%	5.75%	30-35
4. Free Soap	—	0.50%	0.05%	36-40
5. Bound Styrene	22.5%	24.5%	24.0%	25-29
6. Viscosity, Raw Polymer ML 212 F @ 4 minutes	46	56	50	ASTM D927-57T
7. Viscosity, Compounded ML 212 F @ 4 minutes	—	70	60	

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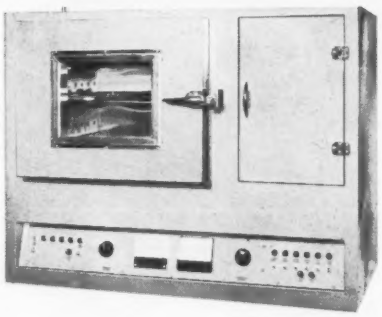

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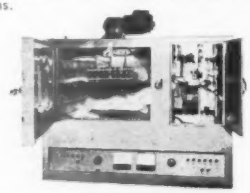

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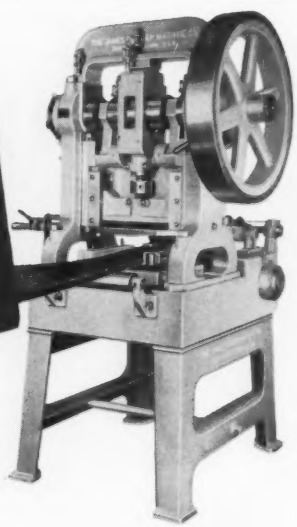

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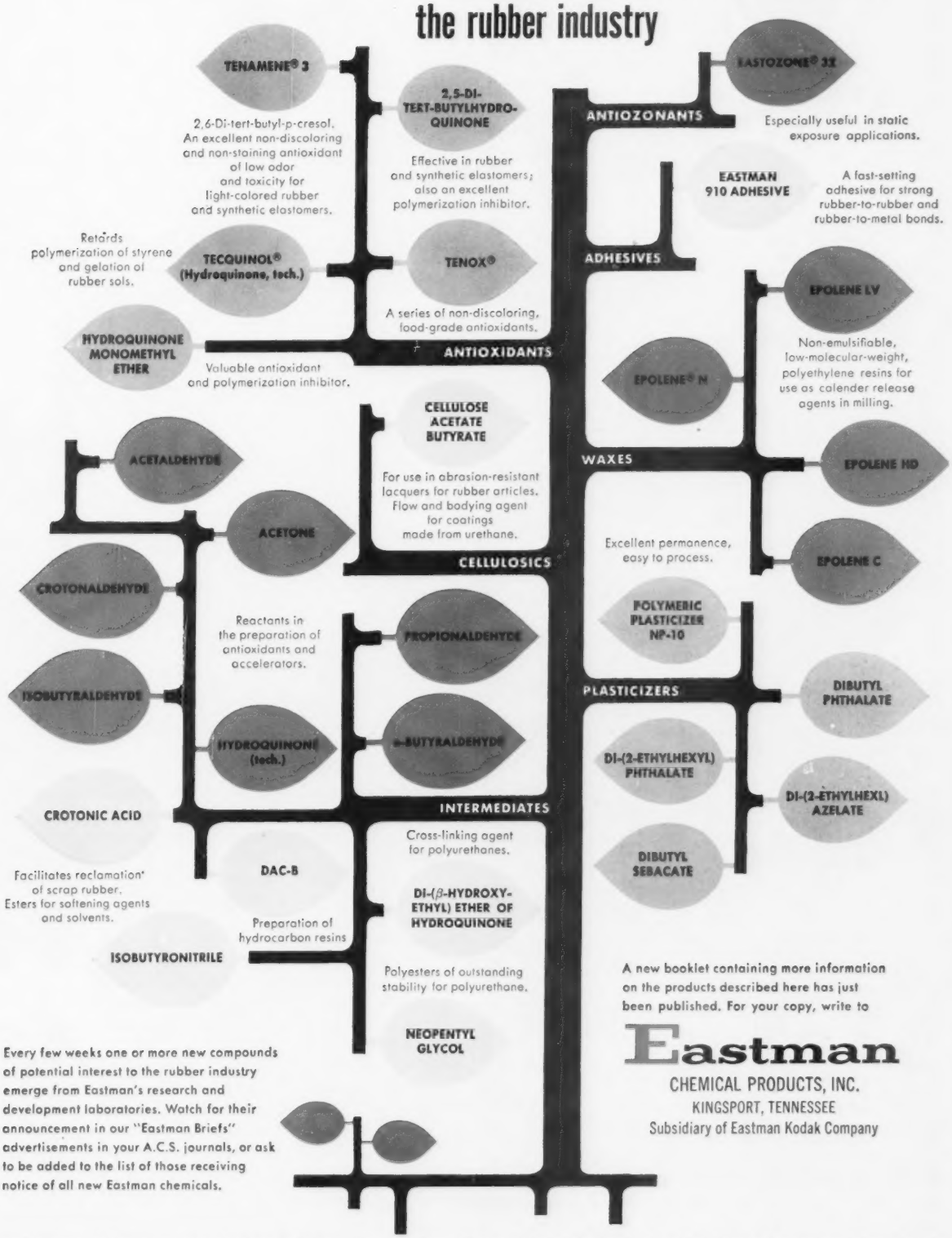

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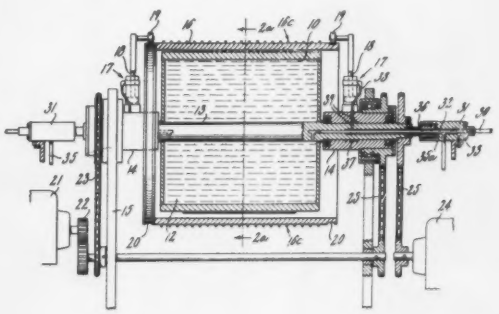
PATENT REVIEW

by Melvin Nord

Apparatus for Processing Elastomeric Material

U. S. Patent 2,944,285, issued July 12, 1960, to Thomas J. Rhodes, and assigned to United States Rubber Co., describes an apparatus for use in curing elastomers under heat and pressure, in consolidating and vulcanizing layers of elastomeric materials or elastomer-coated fabrics, in molding elastomeric articles, and in embossing sheets of elastomeric materials.

As shown in the illustration, the apparatus includes a heated hollow drum (10) containing hot oil (12) for heating its exterior surface. A



ring (16) loosely surrounds drum (10). The ring (16) is pressed against the drum (10) by a pair of hydraulic cylinders (17) rotatably mounted on the central shaft (13) and attached to the sleeves (14). The cylinders (17) have wheels (19) riding in tracks (20) of the ring (16) for pressing the ring and drum together over a 45° arc. This pressing means is rotated to cause a continuous displacement of the area of pressure between the ring (16) and drum (10). Rotation is controlled by a drive motor (21), connected through gears (22) and drive chains (23), to the rotatable sleeves (14), and thereby rotating the sleeves, on suitable bearings, with respect to the central shaft (13). An extruder (40) feeds the apparatus with the stock to be processed.

The drum (10) rotates and the ring (16) rolls around the drum in the opposite sense to the rotation of the drum and at a speed to prevent substantial angular displacement of the ring. The means for rotating the drum (10) includes a drive motor (24) connected through a suitable drive chain (25) to the control shaft (13). Ring (16) is heated by means of windings (16c).

As the stock proceeds on its path along the continuously revolving drum, each increment of

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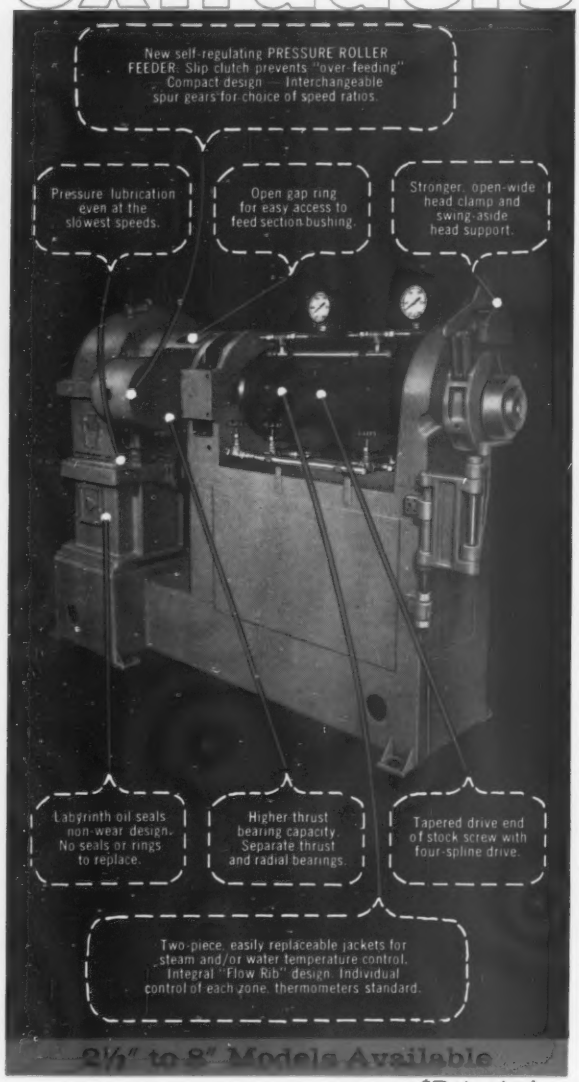
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PATENT REVIEW

stock is subjected to a series of intermittent pressing actions. Each time the rollers running on the track in the ring (16) pass over the portion of the ring along the same radius as the increment of stock, the ring presses against the stock which is thereby compressed between the ring and the drum. Upon the rollers passing beyond this point, the pressure on the increment of stock is immediately released. The frequency of pressure waves on an increment of stock is on the order of one pressure wave every second or two. The purpose of these successive pressure waves is to enable the stock to be cured through the application of heat without danger of blowing or expanding it at the same time. If the stock were allowed to pass, without any pressure application, over a heated drum, it would, while curing, expand in a generally random pattern.

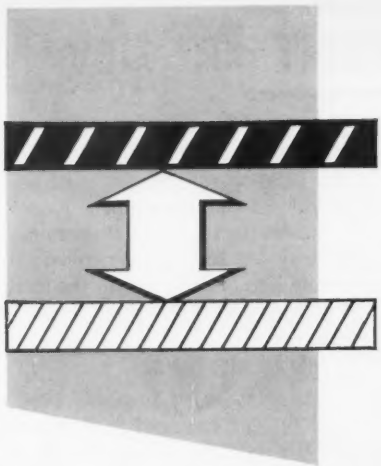
Rubber-Base Floor Material

U. S. Patent 2,940,887, issued June 14, 1960, to Lawrence E. Daly and Charles M. McClure, assigned to the United States Rubber Co., provides flooring material especially adapted for use in making automobile floor mats having improved wear characteristics.

It has been found that an automobile floor covering material having a much more attractive appearance and a much longer service life can be made by providing a vulcanized laminate of an underlying vulcanized rubber layer (formed either of solid vulcanized rubber stock or of sponge rubber, blown and simultaneously vulcanized to the wear-resisting layer) with a wear-resisting rubber-resin layer formed from a vulcanized homogeneous blend of (1) from 50 to 95% by weight of natural rubber, a rubbery copolymer of butadiene and styrene, a mixture of natural rubber and rubbery butadiene-styrene copolymer, or a rubbery copolymer of butadiene and acrylonitrile, and (2) from 50 to 5% of a hard thermoplastic resinous copolymer of from 70 to 90% of styrene and from 30 to 10% of butadiene, the material in each of these layers being vulcanized and these layers being simultaneously vulcanized to each other at their interface during vulcanization of the laminate.

The laminate consists of a rubber backing layer and a rubber-resin, wear-resisting layer. A design is printed on the exposed surface of the rubber-resin layer.

Two layers of base stock and face material, respectively, are passed through the nip of heated laminating rolls to form an uncured laminate. This laminate has the exposed surface of the wear-resisting layer printed by passage around a printing roll which applies a design. The laminate is



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PATENT REVIEW

pressed against the printing roll by means of another roll. The printed laminate then passes through a dryer, wherein the solvent is evaporated. The dried printed laminate can then be rolled up preparatory to cutting into blanks prior to the final molding and vulcanizing operations.

Deposition of Rubber onto Asbestos Fibers

U. S. Patent 2,940,893, issued June 14, 1960, to David A. Feigly, Jr., and Leonard N. Ray, Jr., assigned to the Armstrong Cork Co., provides a method of making a felted asbestos sheet by depositing rubber onto asbestos fibers. An aqueous slurry of asbestos fibers containing chrysotile and crocidolite asbestos fibers is prepared. To this is added a synthetic rubber latex, while agitating the slurry. The resulting slurry of coated fibers is then formed into a sheet.

Production of Rubber Gloves

U. S. Patent 2,941,257, issued June 21, 1960, to Frederick L. Davis and assigned to the London Rubber Co., Ltd., describes a method of manufacturing rubber gloves. The method consists of dipping formers into a dispersion of natural rubber latex and, after a short setting period, dipping the coated formers into a bath containing a solution of synthetic rubber in a common solvent for the synthetic rubber and natural rubber, the solution being mixed with an acid such as acetic acid.

Other Patents of Interest

Subject	Inventor or Assignee	Patent No.	Date
Production of pure chloroprene	Knapsack-Griesheim, A. G.	2,938,060	5/24/60
Tread construction	United States Rubber Co.	2,938,560	5/31/60
Making reinforced rubber products	B. B. Chemical Co.	2,938,876	5/31/60
Automatic molding machine	U. S. Rubber Co.	2,939,173	6/ 7/60
Two-way expandable inner bead forming ring for vulcanizing presses	Cleveland Trust Co.	2,939,175	6/ 7/60
Slush-molding method for making footwear	B. F. Goodrich Co.	2,939,180	6/ 7/60
Wrapping device	U. S. Rubber Co.	2,939,259	6/ 7/60
Tire	U. S. Rubber Co.	2,939,502	6/ 7/60
Building ply for tires	Cleveland Trust Co.	2,939,503	6/ 7/60
Tire building apparatus	Cleveland Trust Co.	2,939,508	6/ 7/60
Tire buffing machine	Cleveland Trust Co.	2,939,520	6/ 7/60
Door structure for rubber mixers	Farrel-Birmingham Co.	2,939,616	6/ 7/60

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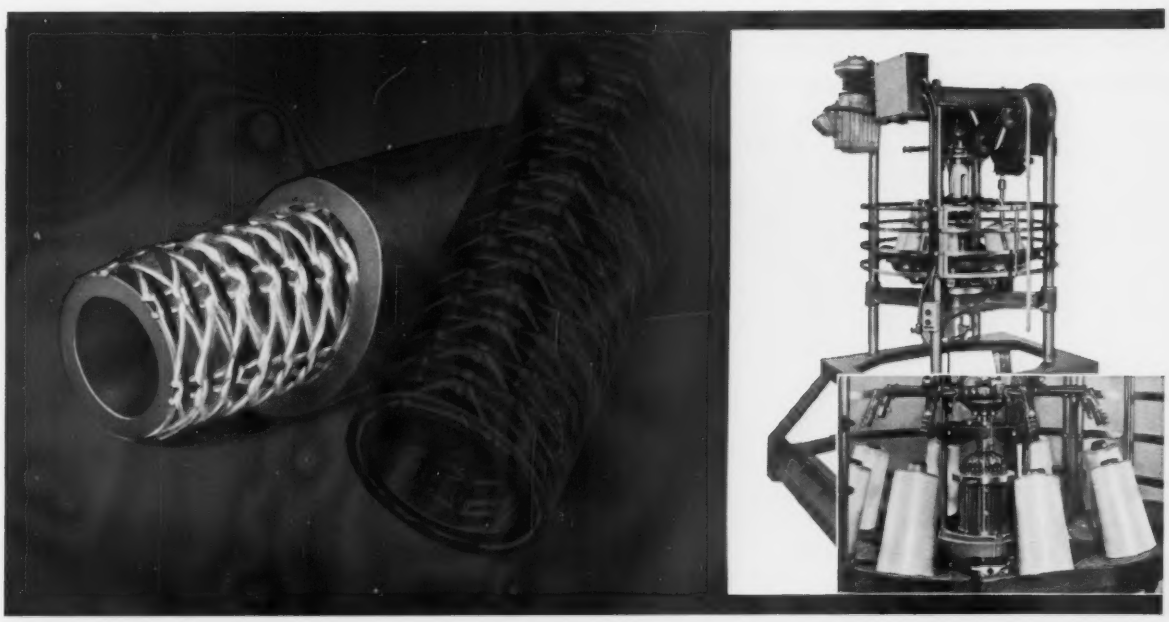

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RUBBER AGE/VOL. 88, NO. 6/MARCH, 1961

High Speed Stress Relaxation

Newly developed techniques aid in determining dynamic properties of elastomers

By R. M. CARDILLO
Project Leader
Enjay Laboratories
Linden, N. J.

W. W. GLEASON
Section Head
Enjay Laboratories
Linden, N. J.

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Plastics Research Laboratory
Massachusetts Institute of Technology
Cambridge, Massachusetts

F. J. McGARRY
Associate Professor of Materials
Civil and Sanitary Engineering Department
Massachusetts Institute of Technology
Cambridge, Massachusetts

INCREASED interest in the behavior of elastomers under high rate—high frequency conditions has led to the development of many new and varied dynamic test techniques. These methods are being used in the support of basic research on elastomer structure and properties, and also in application work in many important fields. These include vibration control in automobiles, aircraft, ships and heavy machinery, sound insulation, and dynamically functioning parts used in suspension systems and the like.

Most of the test procedures employ forced vibration apparatus operating under conditions of constant deformation, constant load, or constant energy. Free vibration tests, such as the Yerzley Oscillograph, and various impact-type tests are also widely used.

The test method used in this investigation represents a relatively new and less widely used approach to the field of dynamic testing. It is based on the principle that the behavior of an elastomeric vulcanizate under conditions of vibration is dependent on the basic viscoelastic properties of the material, as expressed by a distribution of relaxation times. Therefore, the vibration characteristics can be determined from stress relaxation measurements *(1)*.

Using this technique, one can obtain dynamic test data over an extremely broad range of frequencies

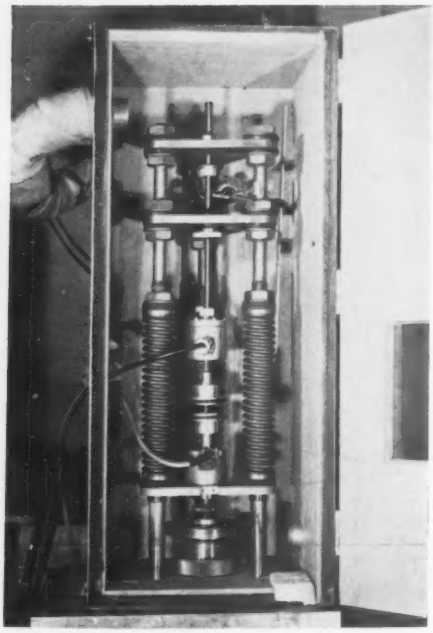

FIG. 1—High-speed stress relaxation tester.

which would be very difficult to cover by a conventional mechanical method. Temperature can also be controlled very readily since one is dealing with a one-shot test without the temperature build-up associated with conventional vibrating dynamic tests.

In this paper, dynamic test data will be reported for butyl and natural rubber covering a frequency range from 10^{-10} to 10^{10} cycles per second and a temperature range from —40°C. to 60°C. This covers the range of conditions of interest to a host of designers confronted with problems in shock absorption, vibration isolation, and acoustical insulation. The tremendous versatility and applicability of this test technique are thus readily apparent.

Test Procedure

Equipment. A picture of the high speed extension apparatus used is shown in Figure 1. A schematic diagram is shown in Figure 2. High rate elongation of the sample is accomplished by means of a piston actuated by compressed gas and three steel coil springs. The sample used is a molded, cylindrical rubber dumbbell. The test area of the dumbbell is 0.75 inches long and 0.75 inches in diameter. The specimen is held in a split collared clamp which is attached to the jaws of the extension device. The sample cross-section and clamping arrangement are shown in Figure 3.

Upon firing, the sample is rapidly extended to a pre-set strain level and load data are recorded. The rate of extension averages 75 inches per second, or approximately 10,000 per cent per second. (This may be compared with the nominal rate of 20 per cent per second for a conventional tensile strength determination.) It should be pointed out that at low temperatures and at high stress levels the apparatus slows down so that the rate falls somewhat below 75 inches per second.

The strain levels indicated throughout this report are "nominal strains" based on cross head travel and original sample length. They do not correspond exactly to strains measured by bench marks or sample extensometers.

In order to obtain data over a wide range of conditions, the entire unit was housed in a temperature control cabinet provided with both heating and cooling capacity. Experiments were run over a range of temperatures extending from —40° to 60°C.

Load relaxation data were recorded by a combination of three methods:

(1) A fast oscilloscope with 1/50 second full-scale sweep time.

(2) A slow oscilloscope with one second full-scale sweep time.

(3) A strip chart recorder that records accurately after about two seconds.

The oscilloscope traces were recorded by Polaroid camera photographs. Reproduction of photographs showing both slow and fast scope traces and a transcribed fast scope trace are shown in Figure 4. In this particular figure "zero time" is taken at the point of peak stress, the beginning of the relaxation period. The damped oscillation at the beginning of the loading curve is attributed to a transient in the load cell resulting from initial loading shock. When one combines the various recorded traces from the two oscilloscopes and the recorder, a continuous curve of stress versus time is obtained. A plot of this nature is shown in Figure 5.

For testing purposes, all samples were conditioned

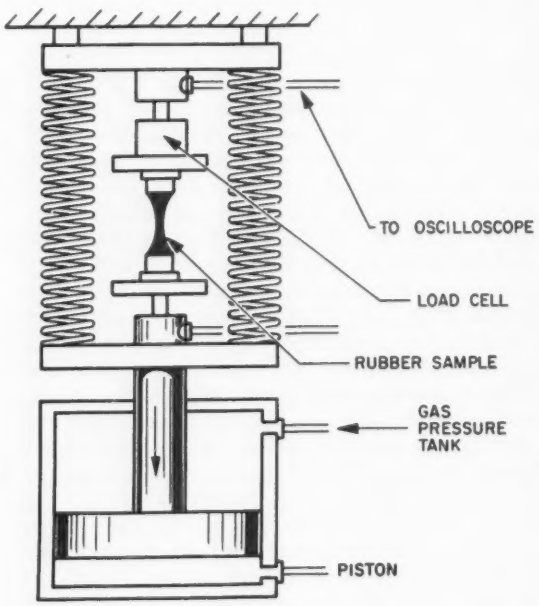

FIG. 2—High-speed stress relaxation apparatus.

Summary

The dynamic properties of elastomers can be determined through the use of high speed stress relaxation tests. A device has been perfected for rapidly extending samples by a combination of spring and pneumatic force. Maximum rate of extension is approximately 75 inches/second, or 10,000 per cent extension/second. Strain levels up to 450 per cent are possible. The relaxation of the sample after maximum strain is reached is recorded by oscilloscopes and a pen-type chart recorder.

A mathematical analysis based on viscoelastic theory is used to relate stress relaxation data to dynamic data such as would be obtained from high frequency vibratory testing. Through the use of the time-temperature superposition principle and controlled low temperature tests, results can be extended over a very broad range of frequency and temperature conditions.

A complete analysis was performed on two stocks, one of natural and the other of butyl rubber. Tests were run at 50, 150 and 300 per cent elongation and temperatures from —40°C. to 60°C. Results are presented in the form of modulus curves (real and imaginary parts of the complex modulus, and the total complex modulus) over approximately twenty decades of logarithmic frequency up to 10^{10} cps.

Dynamic modulus curves for the two rubbers are similar in general shape, and show a characteristic rise with increasing frequency. Natural rubber shows less frequency dependence than does butyl rubber, but undergoes a more pronounced temperature shift. Damping (as measured by loss modulus) was higher for the butyl rubber and reached large values at much lower frequencies than the natural rubber.

The test technique described should be useful in complementing mechanical vibratory test data and especially in studying the ultra high frequency response of elastomers at virtually any strain level. It can also be used as an efficient and rapid screening test for the effect of compounding variables on high frequency behavior.

by one rapid extension to the test strain level. The sample was held in the extended position for about 25 seconds, allowed to recover for twenty minutes, and then evaluated under test conditions, and the data recorded. This procedure was employed since the stress levels recorded in the second and subsequent elongations agreed fairly well among themselves but were considerably lower than the levels recorded during the first extension. This phenomenon is fairly common and is generally attributed to carbon black "structure" or grouping in the unconditioned vulcanizate.

Obtaining Dynamic Data

Data Analysis. The actual procedure used for obtaining dynamic data will be summarized very briefly in this paper. A complete treatment of the concept of obtaining dynamic data from stress relaxation curves is given in references *(1)* and *(2)*. The steps involved are as follows:

(1) Samples of the same stock are tested at the same strain level over a broad range of temperatures and the stress relaxation data are recorded.

(2) The stress relaxation curve at each temperature is "normalized" to the base temperature, 25°C. This is done by multiplying the stress by the factor:

$$\frac{(298)}{(\text{Test Temperature } ^\circ\text{K.})}$$

The stress values thus obtained are termed "reduced stress".

This procedure is based on the proportionality of stress to absolute temperature found experimentally for rubber-like materials *(3)*.

(3) The normalized stress curves are fitted end to end (superposed) on a scale of logarithmic time using the "time-temperature superposition" principle. According to this principle, curves of reduced stress obtained at different temperatures, but over the same time or frequency range, will exactly superpose on one another by suitable lateral shifts along a logarithmic time or frequency scale.

In practice, the test temperatures and relaxation period are so chosen that there is considerable overlap when the curves are shifted. The coincidence of any two curves in the region of overlap is an important criterion of the internal consistency of the data. Starting with a reference relaxation curve obtained at any given temperature (about 25°C.), and shifting curves measured at other temperatures to superpose on the 25°C. curve so as to extend it to both longer and shorter times, gives a composite relaxation curve. This latter master curve defines the relaxation behavior at 25°C. over a much wider frequency range than that determinable by direct experiment at that temperature.

The time-temperature superposition principle was

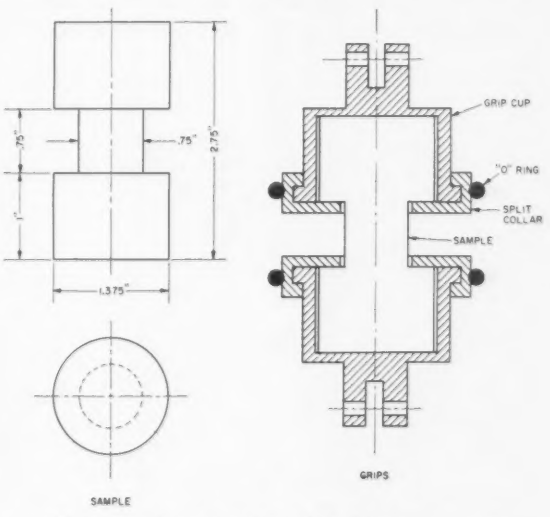

FIG. 3—Sample cross section and clamping arrangement.

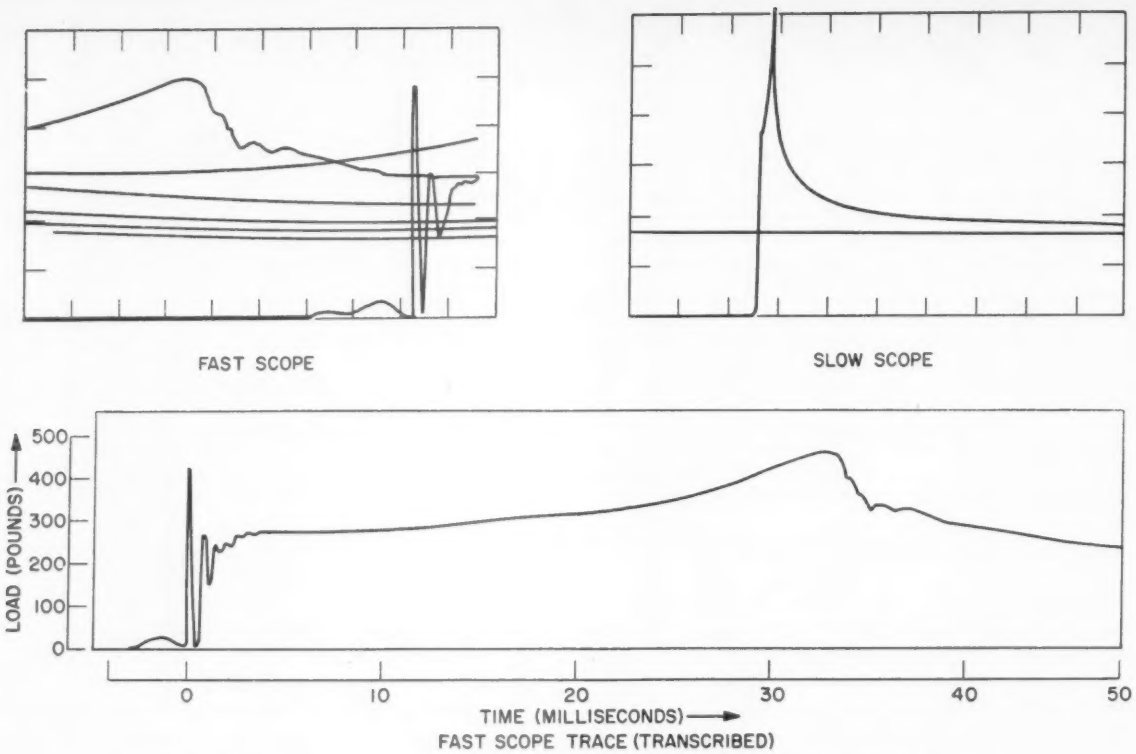

FIG. 4—High-speed stress relaxation oscilloscope traces. "Zero time" is taken at the point of peak stress.

demonstrated empirically for rubber-like materials under conditions of stress relaxation and is explained by the theory of rubber viscoelasticity *(4)* and *(5)*.

(4) The reduced stress vs. log time plot is then transformed to a curve of dynamic modulus (in this case, the *real part* of the *complex dynamic modulus)* vs. frequency in radians/second. This operation simply involves a change in the abscissa (log time) scale, and is based on the fact that the apparent stress in a stress relaxation experiment at any given time is approximately equal to the real part of the complex dynamic modulus at a frequency value in radians per second which is the reciprocal of the time value in the relaxation experiment. For convenience of presentation in this paper all results are presented in terms of cycles per second rather than radians.

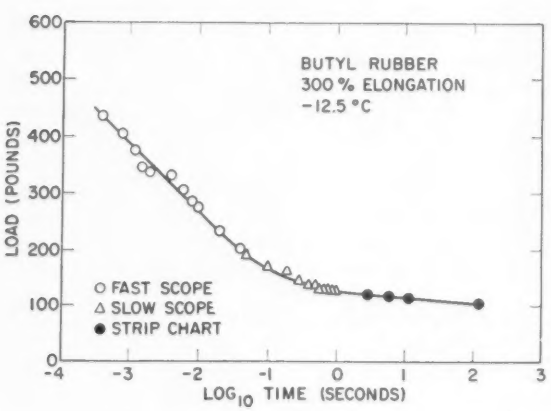

FIG. 5—Composite stress relaxation curve.

It should also be emphasized here that throughout this report "modulus" refers only to a stress level at the strain indicated. In no case is the stress divided through by the strain level. Stresses reported are based on the original cross-section of the sample.

In most low rate or "static" testing, the rubber industry in general refers to a stress value at an indicated strain level as "modulus". However, most dynamic data such as those obtained through vibratory tests are reported in terms of a true modulus (i.e., stress divided by strain, or the slope of the stress-strain curve). These tests are usually run at low amplitudes where such a concept is useful. At the very large amplitudes studied here, a tangent or slope modulus has little significance due to the complete non-linearity of the stress strain curve. It was deemed most convenient to report stress values (based on original cross-section) but to refer to them as "moduli" in order to conform to the commonly used terminology such as "real part of the complex dynamic modulus," "loss modulus," etc.

(5) The imaginary part of the complex dynamic modulus, or the loss modulus, is obtained from the first derivative of the dynamic modulus (real part) vs. frequency curve. This operation is based on vis-

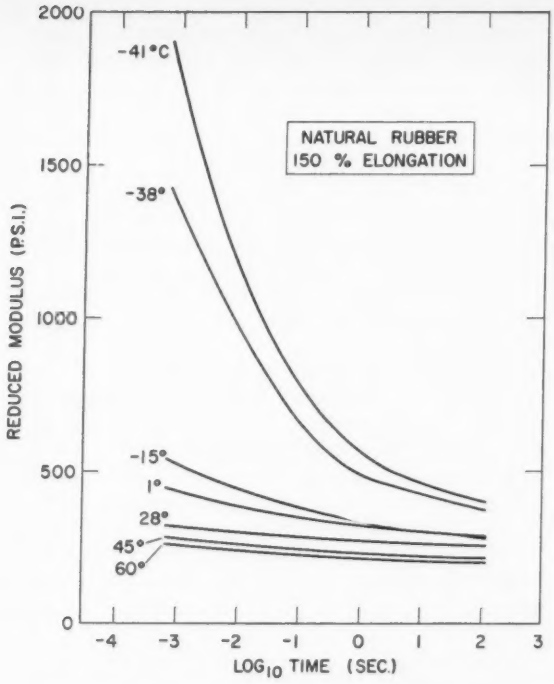

FIG. 6—Stress relaxation curves at various temperatures.

coelastic theory and the assumption of an infinite distribution of relaxation times *(2)*. It also makes use of certain approximate relationships so as to considerably simplify the mathematics involved.

(6) Having determined the real and imaginary parts of the complete or complex dynamic modulus, it is possible to calculate the latter as it is measured in forced vibration tests. The complex modulus is determined by taking the square root of the sum of the squares of the two component moduli.

$$E_{complex} = \sqrt{(E'_{real})^2 + (E''_{imaginary})^2}$$

Figure 6 shows the normalized stress relaxation curve at various test temperatures

$$\text{(stress values multiplied by } \frac{298}{T}\text{)}.$$

Time zero is always taken at the peak stress value, or the start of the relaxation portion of the curve. Figure 7 shows the data in finished form: real part of the complex dynamic modulus vs. log frequency. (Again, "modulus," as used here, refers to a stress value at some strain level, not a tangent modulus taken from the slope of the stress/strain curve.)

The validity of the high frequency data depends on the speed of sample extension. The theory used assumes that all relaxation mechanisms are operative only in the relaxation portion of the test. This would be strictly true, of course, only if the sample were extended instantaneously. While this is impossible,

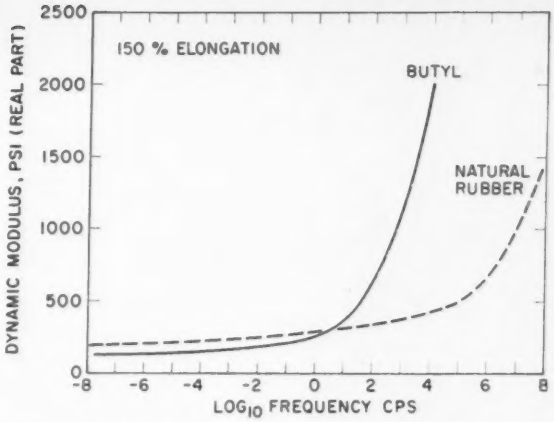

FIG. 7—Dynamic modulus (real part) vs. log frequency at 25°C.

it is essential that the extension be performed as rapidly as possible.

To illustrate the reasons for this, the effect of loading rate on the total stress relaxation curve is shown in Figure 8. The increase in stress build-up and stress relaxation with increasing loading rate is clearly shown. Since this is characteristic of the "high frequency" behavior of the polymer, data derived from an analysis of low speed loading curves are invalid. The effects of short-time, high-rate mechanism are lost in the low speed tests.

The effects of test temperature and strain level on extension time are shown in Figure 9. As would be expected, rise time increases with increasing strain level and reduction of temperature, although the latter influence is not great down to 0°C.

An excessive increase in rise time, at very low temperatures or high strains, can affect the validity of the high frequency results. The test check on the

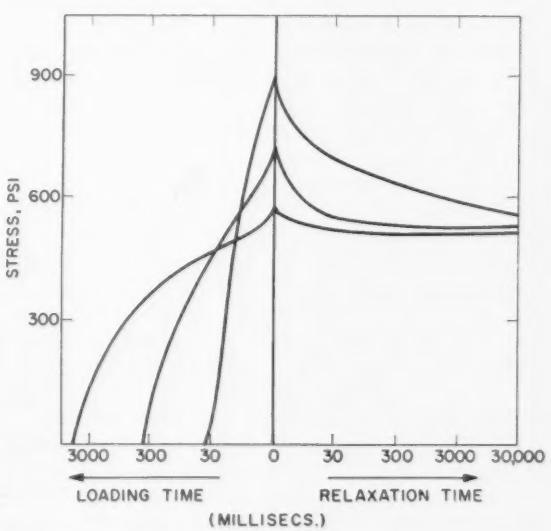

FIG. 8—Effect of loading time on stress relaxation.

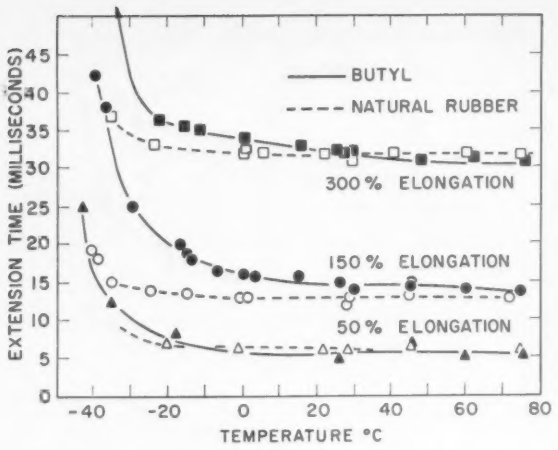

FIG. 9—Time required for extension vs. temperature.

error introduced by increasing rise time is the smoothness with which the curves superpose. Based on this criterion, in the experiments described in this paper, the errors introduced even at the lowest test temperatures were generally not large enough to affect the results significantly. In only one case (see Dynamic Behavior, which follows) was there any indication of inconsistency in the results obtained.

To insure the highest degree of precision obtainable and to extend the operation to even lower temperatures, a reduction can be made in the cross-sectional area of the test specimen to decrease the load on the machine and hence the extension time.

Dynamic Behavior

In order to demonstrate the utility and applicability of the high speed test technique, results of a complete study on one natural rubber and one butyl rubber compound will be presented. Compound formulations and physical test data for these two stocks are shown in Table I. Using the analysis described earlier in this paper, results are shown in Figures 10-12.

Figure 10 contains composite data on the real part of the complex dynamic modulus for natural and butyl rubbers at 50, 150 and 300 per cent elongation, at a temperature of 25°C. The following observations can be made:

(a) Butyl rubber develops a higher modulus at lower frequencies than does natural rubber. Curves, however, are of similar shape for both elastomers. Undoubtedly, the use of plasticizers and other compounding agents would have an important effect in shifting these curves laterally along the frequency axis. The compounds studied were standard recipes (containing 40 phr EPC black and no plasticizer), and were not designed to bring out the optimum dynamic behavior characteristics of either polymer.

(b) The 300 per cent elongation curve for natural rubber crosses over the 150 per cent curve. The 150 and 300 per cent curves for butyl also converge and would presumably cross at higher frequencies. It is believed that this crossover is the result of the change in rate of loading which occurs at low temperatures and high strains (discussed earlier). It is conceivable, of course, that some change in structure could be responsible under the drastic conditions of these experiments. Additional testing on smaller cross-section samples (to increase loading rate) would be helpful in clarifying this cross-over phenomenon.

Figure 11 presents similar data for the imaginary component of the complex dynamic modulus, or the loss modulus. The loss modulus, that component which is 90 degrees out of phase with the real part of the dynamic modulus, is indicative of the damping qualities of the formulation in question. The data show that:

(a) Butyl exhibits much higher damping (hysteresis) than natural rubber at lower frequencies. The difference between the two is especially significant in the 1 to 10,000 cps frequency range. Both polymers develop considerable hysteresis at very high frequencies. These data bear out the usefulness of butyl in applications where vibration dampening is essential.

(b) At low frequencies, loss modulus increases with strain level for both rubbers. At high frequencies, loss modulus is greatest for the lowest strain level. This effect was consistent for both rubbers.

(c) Viscoelastic theory predicts that the curve of loss modulus vs. frequency should peak at the center of the dispersion range (when the real part of the dynamic modulus goes through an inflection point). After this peak, the loss modulus should fall off rapidly as the ultra high frequencies are reached. The curves in Figure 11 seem to indicate that this peak has been reached. Although this may indeed be the case, there are several reasons for treating the data with caution.

First, this part of the data is derived from the lowest temperature tests (—40°C.) and thus cannot be fully checked by the smoothness of superposition. Perhaps more important is the fact that the loss curves are obtained from the first derivative of the real part of the dynamic modulus curves. Since these curves change very little in slope at the high frequency end, a straight line approximation in the dynamic modulus plot would result in a plateau in the loss curves. Additional testing at temperatures below —40°C.

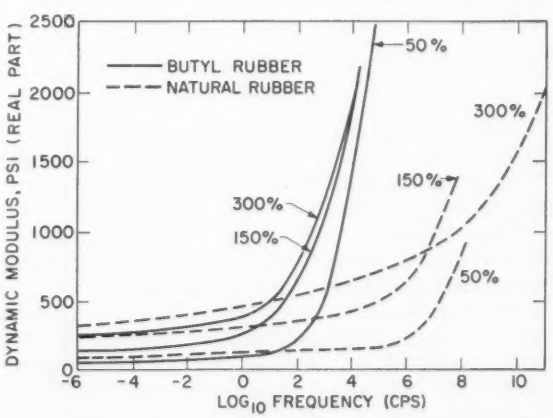

FIG. 10—Real part of dynamic modulus vs. log frequency for 25°C.

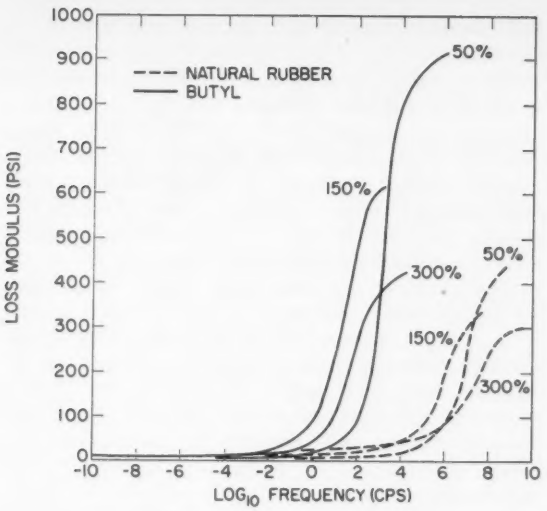

FIG. 11—Loss modulus vs. log frequency for 25°C.

would be necessary to determine if the loss modulus peak has really been reached.

In order to fully demonstrate the utility of this test technique, it is necessary to bring out the combined effects of frequency and temperature. This is covered in the following paragraphs. In this analysis, also, performance data will be expressed in terms of the complete or complex dynamic modulus (the vector sum of the real and imaginary components, that is), since that is the form in which the data would be directly available through mechanical vibratory testing.

Data showing the combined influence of frequency and temperature on the standard natural and butyl rubber compounds are presented in Figure 12. The data in Figure 12 were obtained at an elongation level of 300 per cent and cover a very broad frequency range. The large majority of industrial and automotive applications involve relatively low deformation levels in compression or shear, and very limited frequency ranges. However, the technique described is perfectly adaptable to more specialized conditions. The data presented are for illustrative purposes only.

TABLE I—TEST COMPOUNDS

	83220	82321
Smoked Sheet	100	—
Enjay Butyl 215	—	100
EPC Black	40	40
Zinc Oxide	5	5
Sulfur	3.0	2.0
2-Mercaptobenzothiazole	0.5	0.5
Stearic Acid	2.0	1.0
PBNA	1.5	—
Tetramethyl thiuram disulfide	—	1.0
Cure Temperature	**280°F.**	**307°F.**
Optimum Tensile Properties		
Cure, Minutes	35	35
Shore "A" Hardness	65	60
100% Modulus psi	250	180
200% Modulus psi	570	410
300% Modulus psi	1020	780
Tensile Strength psi	3660	2880
% Elongation	625	650
Compression Set "B"		
22 Hours at 158°F.	36.0%	21.4%
Vibratory Test, 50°C.		
15 cps, 10% Extension		
Dynamic Modulus psi	702	584
% Relative Damping	43	54
Internal Viscosity, poises x 10^{-2}	1785	2012

In Figure 12 the complex dynamic modulus (computed as indicated in Test Procedure) has been plotted as a function of frequency with temperature being employed as a parameter. The data cover a frequency spread of over twenty decades, with the temperature ranging from —40°C. up to 60°C. The curves are very similar in character to those shown previously in Figures 10 and 11.

Both rubbers show the expected increase in dynamic modulus with an increase in frequency and a reduction in temperature. The data as presented in Figure 12 make very clear several important aspects of rubber behavior.

The magnitude of the temperature shift is clearly shown. For instance, the dynamic modulus of natural rubber at —40°C. and 1 cps will be equal to the modulus at 25°C. and 10^{10} cps. Lowering the temperature 10 Centigrade degrees is equivalent to in-

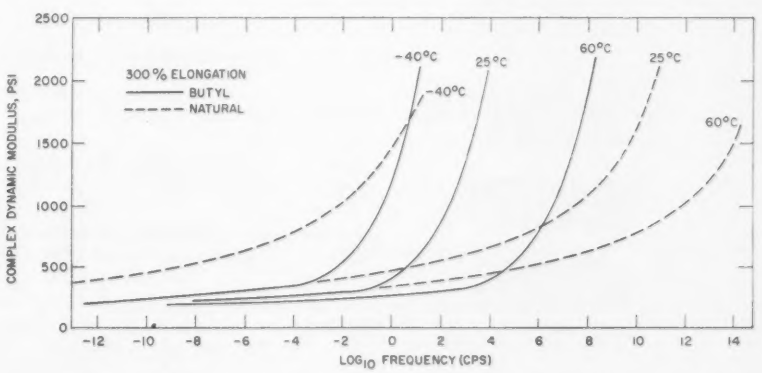

FIG. 12—Complete dynamic modulus vs. log frequency.

creasing the frequency by a factor of 100 (2 logarithmic cycles).

The data also illustrate the "crossover" of dynamic moduli with temperature and frequency. That is, at —40°C. butyl rubber has a lower dynamic modulus than natural rubber until a frequency of about 1 cps is reached. At 60°C. butyl rubber would maintain its lower dynamic modulus until about 100,000 cps. In other words, frequency and temperature of operation must be specified in rating elastomers as to dynamic modulus.

The data further show that temperature has greater effect on the natural rubber stock than it does on the butyl rubber stock. This is clearly shown by the magnitude of the curve shift for natural rubber vs. butyl rubber. The three butyl rubber curves are more closely grouped than the three natural rubber curves. This trend occurs in spite of the fact that the natural rubber curves are less frequency-dependent than the butyl rubber curves over a broader frequency range.

In comparing the data presented here, it is important to note that simple, "standard" formulations were used. Compounding variables would undoubtedly have an important effect on the nature of the results, but were not investigated in this study. Nevertheless, the data should serve for illustrative purposes in bringing out the type and scope of information obtainable from the stress relaxation test method.

Knowing the full spectrum of behavior of the materials under consideration for any given application, the designer can select the material which will give optimum performance under the conditions of intended use. Or again, the rubber compounder can make formulation adjustments to alter the behavior of the materials to provide the desired balance of properties.

The limited amount of experimental data shown in this report emphasizes the sensitivity of elastomers to frequency and temperature changes. It is extremely important to take these factors into consideration in dealing with dynamic applications of elastomers. The high-speed stress relaxation technique offers the scientist a method for obtaining dynamic performance over a range of frequencies, temperatures, and deformation levels virtually impossible to explore in conventional test equipment.

This method may also prove valuable as a rapid and efficient screening test. By judicious selection of one temperature and loading rate, a single test can be made to yield information over the particular frequencies of interest. (Several decades of frequency response are available from each test.) This would eliminate a great deal of the data handling and curve superpositioning necessary for broad frequency spectrum analysis. Rapid screening of the effect on frequency response of various compounding variables could be quickly accomplished in this way.

Endurance or durability data cannot be obtained by this technique, nor does the method take account of heat build-up where this is a factor. This can be turned into an advantage in many instances, however, in that each experiment is performed at a specific known temperature and one can obtain a broad spectrum of temperature response. In the conventional vibrating testers it is difficult to regulate sample equilibrium temperature.

The high speed test method does possess some disadvantages: the data handling procedure is complex, and, although there are checks on the internal consistency of data, verification of the final modulus figures would have to be accomplished by direct experiment. However, the authors feel that the stress relaxation technique has a real place in the dynamics testing field. It can be put to best use as a complement to conventional test equipment to extend the range of variables investigated and data procured. It should also have great potential in basic research as a means of studying broad frequency and temperature response characteristics under very high amplitude deformation.

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(1) "High Speed Stress Relaxation and Dynamic Properties of Rubbers: Part I—Measurements in Tension." Manufacturing Chemists Association, M.I.T. Plastics Research Project, Progress Report (March 1, 1960).

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(4) Toblolsky, A. V., and Andrews, R. D., *J. Chem. Phys.*, Vol. 13, p. 3 (1945).

(5) Andrews, R. D., Hofman-Berg, N., and Toblolsky, A. V., *J. Polymer Sci.*, Vol. 3, p. 669 (1948).

Note: This paper was presented before the Division of Rubber Chemistry, A.C.S., New York, September, 1960.

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Rubber Division Meeting

Louisville, Kentucky, April 19-21

THE 79th meeting of the Division of Rubber Chemistry, American Chemical Society, will be held on April 19, 20 and 21 at the Brown Hotel in Louisville, Kentucky. The meeting will feature the presentation of twenty technical papers, an invited paper and the Charles Goodyear Medal Address. Also on the agenda is a meeting of the 25-Year Club, the divisional business meeting and the divisional banquet.

The invited paper will be delivered by Professor Henry Eyring, dean of the graduate school at the University of Utah. Professor Eyring will speak on "Thermodynamic and Transport Properties of Monomers and Polymers." Dr. Herbert A. Winkelmann, vice-president of the Dryden Rubber Division, Sheller Manufacturing Corp., the 1961 Goodyear Medalist, will discuss "Coatings for Rubber." Dr. Winkelmann will deliver his Goodyear Lecture following the business meeting of the division which will be held on Thursday morning, April 20.

Another feature of the business meeting will be the presentation of the Best Paper Award to Robert M. Murray and J. Donald Detenber (DuPont) for their paper "A Study of First and Second Order Transitions in Neoprene," which was delivered at the 1960 Fall Meeting of the Division in New York City.

The technical sessions will get underway on Thursday afternoon, April 19 with W. S. Coe (Naugatuck Chemical), chairman of the Rubber Division, presiding. Mr. Coe will deliver introductory remarks and present the invited speaker. The technical session on Thursday morning, April 20, will be chaired by past-chairman W. J. Sparks (Esso Research). Thursday afternoon has been set aside for plant visits. The Louisville area contains several synthetic rubber plants and a PVC unit. Trips are planned to DuPont's neoprene facility as well as to plants of the Brown-Forman Distillers and the Brown & Williamson Tobacco Corp.

The several synthetic rubber plants, a PVC unit and several other installations in the area comprise an industrial complex known to local residents as "Rubbertown". Rubber technologists visiting the Louisville area for the first time will find much of pertinent interest at "Rubbertown" and environs.

Activities planned for Thursday evening include the suppliers' cocktail party at the Kentucky Hotel, followed by the division banquet which will be held at the same hotel. A highlight of the banquet will be the presentation of the Charles Goodyear Gold Medal to the 1961 medalist, Dr. Winkelmann.

The technical sessions will resume on Friday morning, April 21. This session will be chaired by G. E. Popp (Phillips Chemical), vice-chairman of the Rubber Division.

For the ladies in attendance a varied and attractive program has been planned. Visits will be made to a famed pottery works and to a restored farm circa 1800. There will also be a trip to "My Old Kentucky Home" in Bardstown, Kentucky, and luncheon at General Electric's Appliance Park where the ladies will see demonstrations of model kitchens.

Abstracts of papers to be presented at the Louisville meeting, follow.

Program of the

DIVISION OF RUBBER CHEMISTRY
AMERICAN CHEMICAL SOCIETY

Brown Hotel, Louisville, Kentucky
April 19-21, 1961

Wednesday Morning — April 19

9:00 A.M.—Registration.
11:30 A.M.—25-Year Club Luncheon, H. O. George, Presiding.

Wednesday Afternoon — April 19

2:00 P.M.—Technical Session.

Thursday Morning — April 20

9:00 A.M.—Technical Session.
11:00 A.M.—Business Meeting.
11:15 A.M.—Charles Goodyear Lecture.

Thursday Afternoon — April 20

2:00 P.M.—Plant Trips.

Thursday Evening — April 20

6:00 P.M.—Suppliers' Cocktail Party, Kentucky Hotel.
7:30 P.M.—Divisional Banquet, Kentucky Hotel.

Friday Morning — April 21

9:00 A.M.—Technical Session.

Wednesday Afternoon—April 19

W. S. Coe, Presiding

2:00 P.M.—1—Introductory Remarks. W. S. Coe, Chairman.

2:10 P.M.—2—Thermodynamic and Transport Properties of Monomers and Polymers. *Henry Eyring (University of Utah, Salt Lake City, Utah).*
Invited Paper.

3:10 P.M.—3—The Structure of Various Natural Rubbers. ***F. W. Stavely, J. L. Binder, P. H. Biddison, M. J. Forster and H. G. Dawson (Firestone Tire and Rubber Co., Akron, Ohio). (Paper will be presented by Mr. Dawson).***

The composition and structure of the well known natural rubbers of commerce, such as Hevea, gutta and balata, have been investigated by many methods including the newer analytical procedures of electron microscopy, x-ray diffraction and infrared spectroscopy. However, there is little available information about the less common rubbers. The latex particle sizes and the structure are reported for the rubber from eight botanical species of rubber producing plants growing in the Plant Introduction Garden of the U. S. Department of Agriculture at Coconut Grove, Fla. Similar determinations of an additional seven rubbers are also given. It is shown that, with the exception of gutta or balata and chicle, all of these rubbers have the same microstructure as Hevea. It is of great interest that so many unrelated plants have an aqueous stereoregulating system that generates polyisoprene of high *cis*-1,4 content. No simple system has yet been found for duplication of this stereosynthesis in aqueous media.

3:30 P.M.—4—Biaxial Fatigue Testing of Vulcanizates. ***S. D. Gehman, P. Rohall and D. I. Livingston (Goodyear Tire and Rubber Co., Akron, Ohio). (Paper will be presented by Mr. Gehman).***

Extensive fatigue tests of vulcanizates of natural rubber and SBR were carried out using a cycle of alternate stretching in two perpendicular directions. It is shown that the data can be best handled statistically by assuming a log-normal distribution or by the use of extreme probability techniques. Illustrative results are given to compare the fatigue life of different types of SBR; to show the value of the method for studying the effects of processing variations on fatigue life; to determine the effect of various loadings of different types of carbon black, and to evaluate the effectiveness of antioxidants and antiozonants. Exploratory tests using ozone instead of pinholes to initiate the failure eliminated the wide range in fatigue life between natural rubber and SBR and in this respect gave a result which is more consistant with general service performance. This type of biaxial fatigue testing has many areas of usefulness for developing good endurance qualities in vulcanizates.

3:50 P.M.—5—Analysis of the Force-depth Relation in the Penetration of Rubber Compounds. ***G. S. Yeh and D. I. Livingston (Goodyear Tire and Rubber Co., Akron, Ohio). (Paper will be presented by Mr. Yeh).***

In view of the promising results obtained in a recent study of viscoelastic behavior of elastomers under complex stress by means of the puncture method, the present work was undertaken to establish if a penetration type measurement can be of use in providing a general criterion of the quality of vulcanizates. On analyzing the force-depth relation of the penetration data a characteristic relation was observed between the penetration force and the penetration depth. A log-log plot of force vs. depth indicated two regions of linearity. This force-depth relation—up to puncture—was found to hold for all the four rubber compounds studied, both gum and reinforced, and over a wide range of temperature and rate.

In the present study, a total of 22 rubber compounds has been used. The penetration force is found to be in direct proportion to Young's modulus in both regions of linearity. The first region, in which the indentor penetrates into the rubber to a depth approximately equal to twice its diameter, can be generally described by Timoshenko's classical relation,

$$F = 2.67\ E\ r\ d \qquad (1)$$

In the second region, an empirically derived equation,

$$F = 1.34\ E\ r^{1/2}\ d^{3/2} \qquad (2)$$

holds.

For a given rubber compound, Young's modulus calculated from equation (2), is in satisfactory agreement with the modulus obtained from equation (1). The relation of the puncture strength and puncture depth with such important variables as the curing time, carbon black loadings and dose for irradiated stocks will also be shown.

4:10 P.M.—6—The Measurement of Structure in Carbon Blacks. ***Andries Voet, William N. Whitten, Jr., and Archie C. Teter (J. M. Huber Corp., Borger, Texas). (Paper will be presented by Mr. Voet).***

Oil absorption has traditionally been the accepted indication for structure in carbon blacks. It is shown that structure is not a single property, but a complex phenomenon. The various aspects of structure may be elucidated by the measurement of electrical properties of blacks dispersed in a fluid vehicle at varying rates of shear. Thus, the increase in electrical conductivity after discontinuation of shear is a measure of the rate of chain formation, while the increase in dielectric constant indicates the growing anisometry of agglomerates. Rheological data are indicative of structure, especially viscosities measured at low rates of shear. The element of dispersibility of the black does not enter into the above approach, contrary to the oil absorption data. A novel approach to structure has been developed, the specific volume of a carbon black at high compression, which appears to correlate well with the structure in dispersions and with the modulus in a vulcanizate. Illustrative data indicate results for commercial regular and low structure blacks as well as for experimental very low structure blacks.

4:30 P.M.—7—The Analysis of Pigment Dispersion in Rubber by Means of Light Microscopy, Microradiography and Electron Microscopy. ***William M. Hess (Columbian Carbon Co., Princeton, N. J.).***

Poor dispersion of reinforcing pigments in rubber can cause a severe degradation of properties. Considerable effort has therefore been put forth toward the development of good reproducible techniques for preparing rubber specimens for examination by means of transmission microscopy. Using a relatively simple liquid nitrogen freezing procedure microtome sections as thick as 40 microns and as thin as 1/20 of a micron have been successfully cut from polymers such as natural rubber butyl, SBR, polybutadiene and silicone rubber. Thus, it is possible to study dispersion from coarse agglomerations of pigment down to the ultimate particles.

New techniques have also been developed for directly studying the effects of variations in pigment dispersion. Using special X-ray and electron microscope tensile specimen holders it is possible to examine rubber samples while they are placed under varying degrees of strain. This type of analysis has sometimes improved the interpretation of other test results and should ultimately provide a better basic understanding of certain phases of rubber reinforcement.

Thursday Morning—April 20

W. J. Sparks, Presiding

9:00 A.M.—8—A Study of Ozone Resistance of Neoprene Vulcanizates. ***Peter Katsenis and E. G. Partridge (TLARGI Rubber Technology Foundation, University of Southern California, Los Angeles, Calif.). (Paper will be presented by Mr. Katsenis).***

Some factors influencing the ozone resistance of several types of neoprene vulcanizates were investigated under accelerated conditions by using as criteria (1) time to first appearance of cracks in a stretched sample, (2) severity of cracking in a stretched sample, and (3) increase in length of samples on cracking under constant load. Testing was done also under dynamic conditions. No critical range of stress, strain or ozone concentration was found. Ozone resistance decreased as elongation and ozone concentration increased. Ozone resistance decreased with increasing amounts of filler and increased with increasing amounts of antioxidants.

Ozone resistance was greatly influenced by the condition of sample surface, cracks being initiated at imperfections. Dynamic tests emphasized differences between compounds which were not apparent in static testing. The effect of modulus on ozone cracking of neoprene compounds was studied by varying the modulus by (1) blends of different

carbon blacks, keeping total loading constant, and (2) varying level of accelerator. Increased modulus by (1) decreased ozone resistance, while increased modulus by (2) increased ozone resistance.

It was concluded that increased ozone resistance with increasing accelerator level was due to either (1) specific antiozonant properties in the particular accelerator used (2-mercaptoimidazoline) or (2) higher degree of cross-linking. The effect of degree of cross-linking may, in turn, be due to the greater resistance of a structure with more cross-links or to reduction of active sites susceptible to ozone attack. Results of the study should be of value in compounding neoprene for improved resistance to ozone. Work is being continued with different accelerator systems and with polymers with different numbers of active sites to clarify the mechanism.

9:25 A.M.—9—Protection of Neoprene Latex Films Against Discoloration by Light. ***R. O. Becker and R. L. Seligman (E. I. du Pont de Nemours & Co., Wilmington, Del.). (Paper will be presented by Mr. Becker).***

The tendency for light-colored neoprene products, particularly those made from latex, to discolor when exposed to sunlight has been studied intensively. This paper reports recent results showing that such discoloration can be inhibited significantly by compounding with certain long chain fatty acids, their alkyl esters or triglycerides in combination with certain non-discoloring antioxidants. Optimum effects are obtained with a combination of a hindered phenol type antioxidant and an oil which consists predominantly of the triglyceride of linoleic acid (safflower oil). Fifteen parts of oil and two parts of antioxidant give optimum results. Whereas these ingredients benefit all types of neoprene latex, most of the data shown pertain to Type 842A and 400. The effect on other physical properties of Neoprene Latex Type 842A films is shown. Variables studied included the amount and type of fatty acid and/or its derivative, amount and type of antioxidant, filler loading, accelerators and commonly used stabilizers for vinyl resins. Samples were exposed under the RS sunlamp, in the Weather-O-Meter (dry), outdoors and at a window facing south.

9:45 A.M.—10—Protection of Neoprene Vulcanizates Against Heat Aging. ***K. L. Seligman and P. A. Roussel (E. I. du Pont de Nemours & Co., Wilmington, Del.). (Paper will be presented by Mr. Seligman).***

The resistance of neoprene toward accelerated heat aging is considerably enhanced by compounding with high molecular weight aliphatic esters. Particularly attractive as stabilizers are the readily available naturally occurring fatty acid glycerides such as rapeseed and safflower oil. Although esters in general appear to be of utility, best results are obtained with those capable of remaining unaltered in the neoprene compound, i.e., those having low volatility and a low degree of unsaturation. Experimental evidence suggests that this stabilizing action is not of an antioxidant nature but rather an interference of the esters with a post-oxidative cross-linking reaction which normally leads to polymer embrittlement.

10:05 A.M.—11—Differences Between Butadiene-Acrylonitrile Copolymer Blends and Single Copolymers. ***Carl E. Fleming (B. F. Goodrich Chemical Co., Avon Lake, Ohio).***

It has been reported that the oil and fuel resistance of a nitrile rubber is a direct function of the amount of acrylonitrile present regardless of how the acrylonitrile is combined. With the commercial introduction of a very high acrylonitrile polymer, it was possible to check this theory with polymers covering a broader range of acrylonitrile contents than reported on previously. A variety of copolymers in the range of 20 to 48 per cent acrylonitrile were blended in pairs to produce an elastomer blend of 30 per cent acrylonitrile. It was found that blends made from polymers of widely different acrylonitrile contents provided oil and low temperature resistance quite different from predicted results. It appears that volume change is a linear function of the two copolymers involved in the blend, and, thus, the swell in oils and fuels exhibited by blends of identical acrylonitrile content can be very different from one another, the magnitude of difference being dependent on the proximity of acrylonitrile contents of the blended polymers.

10:20 A.M.—12—Swelling Effects of Liquids on Nitrile Rubbers. ***Phillip H. Starmer and Carl H. Lufter (B. F. Goodrich Chemical Co., Avon Lake, Ohio). (Paper will be presented by Mr. Starmer).***

Many attempts have been made to obtain information on the swelling behavior of various elastomers in liquids in an effort to choose the best rubber for a specific application. Relationships have been found between the volume change of a rubber and some characteristic of the liquid such as chemical structure, aniline point or solubility parameter. Certain limitations have restricted the full use of such relationships. An alternative approach, to obtain a correlation between the volume change given with a particular liquid and some property of the rubber, was investigated.

Tests were undertaken on a range of nitrile rubbers plotting the volume change against the acrylonitrile content of the rubber. When it was found that for a particular liquid the points could be described by a Gaussian type curve, an attempt was made to relate the constants of the equation with the physical characteristics of the liquid. It is postulated that the acrylonitrile content of the polymer which shows maximum swelling in a given liquid is related to the dielectric constant of that liquid and the value of maximum swelling is a function of the absolute temperature and the molar volume of the liquid.

10:40 A.M.—13—Development and Application of a High Solids Nitrile Rubber Latex. ***J. M. Mitchell, G. K. Watson and H. L. Williams (Polymer Corp., Sarnia, Ont., Canada). (Paper will be presented by Mr. Mitchell).***

Many uses for rubber latex require better resistance to hydrocarbon oils than is found in SBR or natural rubber. Improved oil resistance is achieved by use of a butadiene-acrylonitrile copolymer latex. The further requirement of high solids content is critical in latex foam rubber applications. The "freeze-agglomeration" technique has been used successfully to produce a nitrile rubber latex with solids content adequate for foam rubber compounding. The colloidal properties displayed by this latex will be described as well as the foam rubber compounding technique necessary to produce foam rubber with good structure and physical properties.

Data will be presented to illustrate the effect of polymerization and compound variables on the physical properties of the latex foam rubber. Information will be given on the effect of a lubricating type oil on such properties as per cent elongation, tensile strength, compression modulus and flex life of the foam rubber with unaged and aged foam specimens. Comparative data will be shown for SBR, natural and polychloroprene foam. The influence of inert fillers on the compounding behaviour of the nitrile rubber latex and on the physical properties of the foam rubber product will be discussed. The use of nitrile latex foam rubber in journal lubricating devices for railway freight cars will be reviewed in relation to the known requirements for this application.

11:15 A.M.—14—Coatings for Rubber. ***H. A. Winkelmann (Dryden Rubber, Chicago, Ill.).***

Charles Goodyear Medal Lecture.

Thursday Afternoon—April 20

2:00 P.M.

Plant visits.

Friday Morning—April 21

G. E. Popp, Presiding

9:00 A.M.—15—Urethane and Urethane-Urea Elastomers Prepared by a One-Shot Method. ***S. L. Axelrood, C. W. Hamilton and K. C. Frisch (Wyandotte Chemicals Corp., Wyandotte, Mich.). (Paper will be presented by Mr. Axelrood).***

One-shot urethane and urethane-urea elastomers were developed based on polyether polyols, tolylene diisocyanate and hindered aromatic diamines (the latter being used only for urethane-urea polymers) as the major constituents. A key for the successful preparation of these polymers was the utilization of efficient catalysts for the isocyanate-hydroxyl reaction, to allow a rapid build-up of the polymer containing suitably spaced cross-links. In the preparation of urethane-urea elastomers, it was especially important to balance the isocyanate-diamine and isocyanate-hydroxyl reaction rates by proper catalysis in order to obtain polymers with desirable combinations of properties. Metal salts of organic acids, among them stannous octoate and lead naphthenate, appeared to be especially suited for accelerating the slower isocyanate-hydroxyl reaction.

Statistically designed experiments were carried out to determine factors affecting the polymer structure, and to relate the structure to physical properties of the resulting cured elastomers. These included the effects of type and amount of catalyst, average equivalent weight of the polyether polyol used, the ratio and distribution of urethane and urea groups, and cross-link densities. For urethane-urea elastomers, the type of diamine used [4,4′-methylene-bis (o-chloroaniline) and 3,3′-dichlorobenzidine] was investigated. A study was also undertaken of the curing conditions with the aim of arriving at a practical cure cycle with a minimum molding time.

Processing techniques were developed to allow the rapid casting of small batches of one-shot urethane and urethane-urea polymers. In addition, feasibility studies were carried out with urethane elastomers on commercially available casting machines resulting in satisfactory bubble-free castings.

The physical properties of the urethane and urethane-urea elastomers prepared by the one-step process were similar to those made by the prepolymer route. The one-shot casting technique, utilizing a suitable casting machine, allowed the preparation of these elastomers directly from the raw materials with considerable reduction in processing time. Hence the one-shot process appears to provide an economic advantage in the expanding urethane elastomer market.

9:20 A.M.—16—New Techniques in Processing Urethane Elastomers. ***K. A. Pigott, J. W. Britain, William Archer, B. F. Frye, R. J. Cote and J. H. Saunders (Mobay Chemical Co., New Martinsville, W. Va.). (Paper will be presented by Mr. Pigott).***

Urethane elastomers have been under development in this country since World War II. The initial research was done on the so-called "millable" types. About 1955 the liquid "casting" systems were introduced. Although both types have enjoyed moderate commercial success, extensive commercial utilization has been hampered by the required long mold cycles. Mass production of these relatively expensive products requires a much less expensive means of fabrication in order to be price competitive.

Using similar raw materials as are used in the polyester casting system, a new process has been developed to give a semi-cured product which can be processed by extrusion, injection molding, transfer molding, blow and compression molding. Many of the ultimate properties are obtained without additional cure, but an oven cure provides cross-linking to give low set and the best solvent resistance. Properties are obtained which are equivalent to those achieved via the casting technique.

Polyester urethane elastomers can be produced which range in hardness from Shore A-60 to Shore D-70. In many cases this range is more easily obtainable by this new technique. The other desirable properties, such as abrasion resistance, ozone resistance, high tensile and tear properties, etc., remain essentially unchanged. However, improved tensile properties can be obtained on extruded fiber or film by orientation with tensile strengths up to 30,000 psi.

It is believed that this new development in urethane elastomers will promote the application of these materials by processes and on equipment which are familiar to the industry. A means of producing large quantities of parts at lower cost has been developed, thus making the urethanes more attractive to the elastomer producer and user.

9:40 A.M.—17—Machine Literature Searching with the IBM-101. ***Leora E. Straka (Goodyear Tire & Rubber Co., Akron, Ohio).***

Because of the increasing volume of technical literature as well as company reports and documents, mechanized information retrieval has recently been initiated in the Research Library of the Goodyear Tire & Rubber Co. The system which has been adopted is based upon the principles of superimposed random number coding, using the IBM-101 Electronic Statistical Machine. This system, which is similar to that used by the Procter and Gamble Co., and Merck, Sharpe and Dohme, has been modified to satisfy the requirements of the Goodyear Tire and Rubber Co., and the rubber industry.

The retrieval system involves the following basic steps in the case of any technical article or document: (1) subject analysis; (2) code assignment; (3) card punching, and (4) machine retrieval. According to the specific card layout which has been designed it is possible to search the subject and author fields for as many as six variables in one pass of the cards at a rate of 450 cards per minute. The card design permits the incorporation of the source information, author, title, and up to twenty-five "descriptors" or "key-words" on the IBM card. A balance of specific requirements, expenditure of effort, and financial expenditures has been given consideration.

10:00 A.M.—18—Injection Molding of Silicone Rubber. ***Robert P. DeSieno (General Electric Co., Waterford, N. Y.) and Robert Fuhrman (Lewis Welding and Engineering Co., Cleveland, Ohio). (Paper will be presented by Mr. DeSieno).***

A knowledge of silicone rubber processing characteristics combined with familiarity in injection molding techniques has prompted effort to study the effects of this molding process on silicone rubber. The relatively soft and plastic unvulcanized silicone rubber compounds lend themselves to the high pressure and high speed flow necessary for the success of injection molding. Considered as an ultra high speed method of molding, the technique appeared to contain potential for achieving measurable economies with respect to raw material consumption and rate of fabrication. Lastly, injection molding appeared capable of modestly enhancing the physical profile of silicone rubber and providing greater reproducibility of fabrication.

Injection molding efforts were conducted on several G-E grade silicone rubbers, using Lewis Welding and Engineering equipment. Significant results were established as follows: (1) Molding cycles for silicone rubber were limited to 60 to 90 seconds, achieving physical properties superior to those established in 15- to 20-minute compression molding operations; (2) Physical profile of injection molded silicone rubber stocks often exceeded that of post baked compression molded formulations. Tensile, tear and elongation values were markedly enhanced by this process; (3) The technique permitted molding cycles using very modest levels of peroxide catalysts. In most instances, injection molded silicone rubber was fabricated using 25 to 50 percent of catalyst levels required by compression molding; (4) Compression set of silicone rubber was enhanced considerably by injection

molding reflecting reductions as high as 25 percent over normal values; (5) Thick section molding and effective deep section cures are nicely established by injection molding, and (6) Shrinkage values for injection molded silicone rubber ran 1 to 1.5 percent higher than compression molded shrinkage.

It is concluded that: (1) The nature of injection molding (high speed flow, small orifice delivery) provides a useful system for establishing consistently high physical property profiles for silicone rubber; (2) Ability to reduce catalyst levels provides leverage for establishing optimum cures and enhanced compression set properties, and (3) Injection molding permits application of fundamental chemical and mechanical theory essential for establishing optimum silicone rubber cure.

10:15 A.M.—19—Determination of Nonylphenyl Phosphite in SBR Latex and Polymer by a Direct UV Spectrophotometric Method. ***Heinz J. Brandt (U. S. Rubber Co., Naugatuck, Conn.).***

A direct spectrophotometric method is presented for the determination of Polygard (a mixture of nonylated phenyl phosphites) specific for phenolic compounds. The method eliminates the need for perchloric acid destruction of organic matter and background correction factors. Extraction from sheet rubber is speeded up by the use of an ultrasonic generator.

10:35 A.M.—20—Antioxidant Efficiency of p-Phenylenediamines in Natural Rubber Vulcanizates. ***O. Lorenz and C. R. Parks (Goodyear Tire and Rubber Co., Akron, Ohio). (Paper will be presented by Mr. Lorenz).***

The kinetics of the consumption of various p-phenylenediamines during the oxidation of natural rubber vulcanizates has been investigated in the temperature range of 80 to 120°C: N,N′-dialkyl—e.g., N,N′-di-(1-methylheptyl)-p-phenylenediamine (DMHPD), N-alkyl-N′-aryl—e.g., N-isopropyl-N′-phenyl-p-phenylenediamine (IPPD), N,N′-diaryl—e.g., N,N′-diphenyl-p-phenylenediamine (DPPD). Oxygen absorption was used to follow the oxidation. The p-phenylenediamines were determined by means of a non-aqueous titration method.

It was found that DMHPD and IPPD were consumed by a direct relatively fast reaction with oxygen which was of first order with respect to the diamine. DMHPD was oxidized faster than IPPD the rate constants differing by a factor of four (at 100°C.). The oxidation products formed exhibited antioxidant activity although the activity of the oxidation products of DMHPD was only moderate.

Diaryl-p-phenylenediamines were consumed by a rather slow zero order reaction. In most cases the oxygen absorption curves consisted of only two stages, a constant rate and an autocatalytic stage. During the constant rate period five to six molecules of oxygen were absorbed per molecule of diamine consumed. The length of the constant rate stage was found to be twice the length of the time needed to consume the diamine, indicating that its reaction product also possessed antioxidant activity. A study of the effect of increasing the initial diamine concentration on the reaction rate in the constant rate stage showed that the rate passed through a minimum and then slowly increased linearly. This indicates that the direct oxidation of the diaryl diamines was only a minor side reaction.

10:55 A.M.—21—The Static U-Adhesion and Dynamic Strip Adhesion Methods for Tire Cord Adhesion Testing. ***W. H. Nicol and D. D. Ray (Goodyear Tire & Rubber Co., Akron, Ohio). (Paper will be presented by Mr. Ray).***

Simple, rapid, and versatile test methods are required for measuring adhesion between cord and rubber portions of tires, belts, hose, and other rubber-fabric assemblies. Two procedures are described for quality control as well as research and development use: the U-Adhesion test, a static method, and the dynamic strip adhesion test.

In the U-Adhesion test a rubber bar is cured so that both ends of a cord loop are embedded in it. The force on the cord loop to pull either cord end from the rubber is a measure of the adhesion. The sample is cured in a removable insert mold. After cure and a simple trimming operation, the insert is fitted into a heater on the tensile test machine allowing the test to be run very simply at elevated temperatures. Due to sample design a high level of cord adhesion may be measured without cord failure. The U-test is well adapted to rapid screening of rubber compounding variables since calendered or milled rubber sheets may be used to prepare samples.

The dynamic strip adhesion test measures the separation rate between plies of a rubber fabric laminate subjected to a dynamic peeling force at elevated temperature. The dynamic strip test is suitable for control testing of calendered fabric in the form in which it is used in tires. Single cords may be tested after conversion to fabric with simple drum building equipment. The severity of the test may be modified by changing the separating force. The failed sample readily shows the weak layer in the rubber-adhesive-fabric system.

11:10 A.M.—22—Some New Interpretations of the Tire Cord Fatigue Phenomenon. ***W. G. Klein, W. J. Hamburger and M. M. Platt (Fabric Research Laboratories, Inc., Dedham, Mass.). (Paper will be presented by Mr. Klein).***

This work is the result of a two-year research program on the mechanics of tire cord fatigue. Tyrex and nylon tires were studied following both normal and abusive conditions of use. The former study involved fleet tests using manufacturers' rated pressure and loading, while the latter study involved fleet tests using severe high speed, low pressure, overloaded conditions. Cords were extracted from the tires of both studies at various mileages, and in many cases filaments were extracted from cords. Attempts were made to relate the changes in properties of the cords and filaments to the problem of "fatigue", and the results of these attempts are described.

Contrary to previous findings reported in the literature, both use conditions result in a normal initial cord strength loss at early mileage, followed by a long period of almost constant cord strength at a level of about 80 per cent of the original cord strength. Hence, it is concluded that cord failure must be "catacylsmic" in nature, possibly reflecting the results of a gradual breakdown in the adhesion between cord and rubber. In addition, some work is presented on the gross mechanisms involved in several laboratory fatigue testers and the relationships of these mechanisms to fiber properties and bond characteristics.

11:40 A.M.—23—Tubeless Tire Performance Related to Inner Liner Properties. ***R. H. Dudley and J. V. Fusco (Enjay Laboratories, Linden, N. J.). (Paper will be presented by Mr. Dudley).***

Air penetration into the carcass of tubeless SBR tires causes inter-ply pressure build-up which can lead to separations and blow-outs. Measurements of air pressure within the plies of tubeless SBR tires were made by inserting hypodermic needles attached to pressure gauges into the carcass area of the tire. In SBR tires inflated to 24 psi, chlorobutyl inner liners gave substantially less inter-ply pressure than an unsaturated rubber inner liner. Similarly, in laboratory permeability tests, chlorobutyl inner liners showed only about one-third as much air permeation as an unsaturated rubber inner liner. The advantage persisted over a broad range of test temperatures corresponding with tire temperatures encountered in service. There was little change in permeability on aging three weeks at 200°F.

In an extended road test of passenger tires, chlorobutyl inner liners in SBR tubeless nylon tires decreased the air loss and reduced the severity and frequency of blow-outs which occurred in tires containing an SBR-natural rubber inner liner. As a corollary of improved air retention, the tires containing chlorobutyl inner liners showed an improved tread wear pattern with less tread loss in the outer ribs.

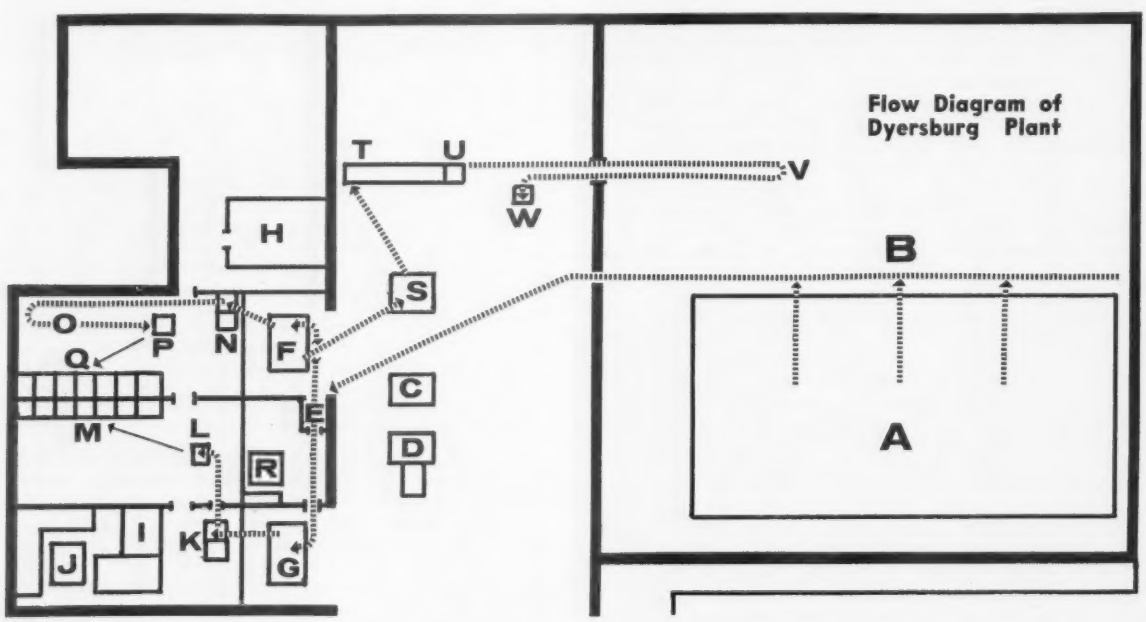
Neoprene Masterbatches

New equipment, manufacturing techniques permit production of a new line of masterbatches for rubber goods producers

NEOPRENE masterbatches, previously unavailable, are now being produced at the Dyersburg, Tenn., plant of Colonial Rubber Works, Inc., primarily to meet a demand from smaller producers of mechanical goods. In order to enter this phase of activity, it has been necessary for the company to considerably enlarge its production facilities. Colonial Rubber has recently installed a No. 10 Stewart Bolling mixer with a complete D.C. drive which will give the rotors a speed range of from 0 to 55 rpm. Also added has been a 100-inch drop mill, also complete with D.C. drive; 125 tons of refrigeration to provide cold water for the mixer and mill; additional refrigerated warehouse space; additional regular warehouse space; a new laboratory and a new office building.

The mixer is the same size as earlier equipment and was chosen particularly for this reason. Uniform mixer size results in uniform batch sizes which simplify weigh-up and mixing procedures. A major departure was made, however, in the choice of a drive for the new mixer which consists of a motor generator set, a D.C. motor and an extra-heavy power transfer unit. This will permit the mixer operator to vary the speed of the rotors while the mixer is in operation.

Colonial Rubber points to a reduction in mixing time and superiority of dispersion since the rotor speed can be increased when power consumption (and work done on the stock) is low, and decreased as power consumption increases. In this way, when the elas-



KEY

.....Overhead conveyor

A—Raw material storage

B—Compounding area

C—60" warm-up mill

D—Farrel 22" x 60" calender

E—Elevator to 2nd floor

F—#10 Bolling Mixer & 84" mill mixer 2nd floor over mill

G—#10 Bolling Mixer & 100" mill mixer 2nd floor over mill

H—Refrigerating equipment for "F"

I—Refrigerating equipment for "G"

J—D.C. generator for "G"

K—Cooling tank

L—Skid

M—Cold storage room

N—Cooling tank

O—Overhead cooling conveyor

P—Skid

Q—Cold storage room

R—D.C. generator for 8½" extruder. Controls for 2-speed #10 mixer motor.

S—60" warm-up mill

T—8½" extruder-strainer

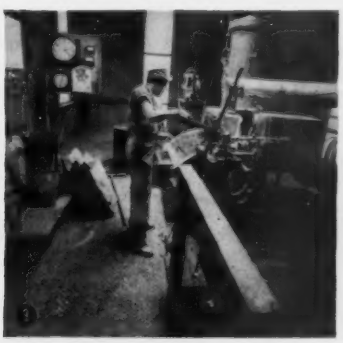
U—Cooling tank

V—Cooling conveyor

W—Skid

Expanded Production Facilities at Colonial Rubber Works

FIG. 1—The new office and laboratory of Colonial Rubber Works; FIG. 2—An overall view of the plant at Dyersburg showing the tuber and strainer in the left background and the warm-up mill in the right foreground; FIG. 3—The new laboratory; FIG. 4—One of two refrigerated warehouses used to store mixed stock. Temperature is held at 70°F; FIG. 5—One of two 10 x 10 2-cylinder ammonia compressors used to chill water for two No. 10 mixers and two sheet-off mills. The guard has been removed for clearer representation; FIG. 6—The 100-inch mill; FIG. 7—The 84-inch mill; FIG. 8—D.C. motor and generator for mixer and 100-inch mill; FIG. 9—The D.C. driven mixer which is found over the 100-inch mill; FIG. 10—Workers lacing a cold feed wire compound into a skid for shipment.



tomer is first charged into the mixer the speed can be increased. This will result in rapid massing of the batch and fast breakdown.

As filler is added and the mixer gets closer to its load capacity, rotor speed can be reduced as necessary to control heat built-up. When oil is added, the rotors can be increased in speed to incorporate the oil rapidly; as acceleration is added the rotor speed can again be reduced to hold temperature and heat history to a minimum.

Very scorchy stocks can be mixed at very low speeds to keep them cool, and rubber masterbatches that are not sensitive to heat can be mixed very rapidly. Mixing time is saved and heat history is reduced. A better mix can be attained because it is not necessary to dump when heat builds up to a specific temperature.

New D.C. Mill Drive

The D.C. drive on the mill is for a similar reason. Heat can be removed from the compound rapidly after dump by pulling it through the nip as quickly as possible on the refrigerated rolls. Then the mill can be slowed down to make it possible for a continuous strip to be removed from the rolls batch after batch. This will be quite an advantage to those customers feeding the cold strip of compound to an extruder.

The 125 tons of refrigeration supplement the 100 tons now in use. One feature of the refrigeration system is that ice can be frozen and used as a reservoir of cold for peak requirements on the system. The refrigeration is used not only to cool the mixer and mill, but also to cool a warehouse. This warehouse stores raw materials as well as mixed compounds and masterbatches, all of which are benefited by storage under refrigerated conditions. This warehouse has been used for several years, but was enlarged to provide the additional capacity required. Another building provides more warehouse space at ambient temperatures.

The new laboratory has separate rooms for weigh-up, mixing and curing, and physical tests. All of these rooms are air conditioned and, in addition, the physical test room is temperature controlled, plus or minus 3 degrees, and humidity controlled. This will insure reproducible results from summer, when outside temperatures are normally above 90°F., to winter, when they drop well below freezing. The laboratory is equipped with the latest in physical test equipment for making many tests, not only on vulcanizate properties, but on the processibility and uniformity of the mixed compound.

As previously noted, neoprene masterbatches are being produced to meet a demand from small manufacturers, although larger companies can also take advantage of the better dispersion offered by these new black masterbatches. The use of these masterbatches will permit many companies to eliminate loose carbon black from their plants. In many cases the masterbatches are close enough to a finished compound so that only curing agents, and antioxidant need be added before cure. The use of these masterbatches also greatly reduces mill mixing time and thereby increases the mixing capacity of many companies.

There are occasions when only small amounts of carbon black are needed in a compound that will be Banbury mixed. The neoprene masterbatch plus raw neoprene, which will reduce the black content to the required level, can be mixed more rapidly in the Banbury. In addition, mineral fillers incorporate more easily. Heat build-up in the Banbury also will be reduced, Colonial officials point out.

Storage tests run for four months show that these masterbatches are at least as stable as the raw polymer. Only very slight changes in viscosity and cure rate were noted after this length of time, attesting to the efficiency and economy of neoprene masterbatches.

The masterbatches now produced by the company include Neoprene Types GNA and W containing 80 to 100 parts SRF, FEF and MT carbon black. Oil is added as necessary for easier processing. Masterbatches are enclosed in a polyethylene bag and packed 50-pounds to a multiwall paper bag. They are in the form of thin slabs for ease in weighing and addition to open mill mixes.

Coming Soon . . .

The Application of Radiation in the Technology of Natural Rubber Latex—By T. C. Gregson, T. H. Rogers, L. B. Bangs, and D. W. Peabody, The Goodyear Tire & Rubber Co., Akron, Ohio.

This study, including preliminary cost estimates, indicates the feasibility of irradiating natural rubber in the latex state to achieve, after coagulation, a material similar to superior processing rubber. Improved properties for several commercial applications are observed.

The Role of Carbon Structure in the Reinforcement of Rubber: The Effects of Lowered Structure—By C. W. Sweitzer, Columbian Carbon Co., Princeton, N. J.

The development of lowered structure carbons for tread rubber now makes it possible for the tire compounder to achieve a more favorable balance between wear characteristics and previously incurred problems with processing, hysteresis, and performance properties other than wear.

Quality Control
in the Rubber Industry

PART

0 1 2 3 4 5

FUNCTIONS • ORGANIZATION • PERSONNEL

By Simon COLLIER and Edward A. REYNOLDS

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THE proper delegation of responsibilities and the good selection of personnel are inseparable problems and should be considered together. Certainly it is not practical to staff a quality control section without first having a clear idea of the section's functions, responsibilities and authorities. Although less readily acknowledged, it is equally true that, especially in the smaller company (or at highest levels in the larger), delegation of responsibilities must often depart from strict theoretical lines and be adapted to the abilities and personalities of the individuals available. To do otherwise will certainly waste available talent and may even disrupt the company by incompetent direction or internal strife.

One of the most important jobs of management, at any level, is to match persons and jobs. In some cases this can be done by selection of men to fill definite assignments; in others by delegation of functions in accordance with available abilities. In most cases, both techniques must be used, and the skill with which this is done will reflect management's ability to fulfill its own assigned functions.

Quality Control Functions

The areas for establishing an improved quality controlling program should be located on a basis of actual need—rather than attempting to "control everything." Obviously the latter type approach will result in a short-lived QC program, ending in its "controlling nothing." If a good estimate of Quality Costs and Losses (see first article in this series) has been made, this will be helpful in determining where in the industrial process improved controls are really required. In addition, management should look carefully at future plans, at competitive items, and at probable market changes. From these, needs for programs aimed at improved reliability or lower costs will often become apparent.

In Exhibit Number One are listed many of the common quality controlling functions. For each of these (plus others particular to the individual company) the management executive should ask three questions:

(1) *Who now does this function?* If this is not known, a clarification of responsibilities is indicated at least.

(2) *Are improvements needed?* If so, appropriate actions should be planned. These may be basic changes in responsibilities or organization, or may require follow-up, better planning, or approval of necessary funds for equipment or personnel, etc.

(3) *Should this function be performed by a Quality*

This second in a series of five articles discusses the quality control function with information as to responsibilities of other company departments and details as to the quality control organization and the training, direction and evaluation of personnel

EXHIBIT I

Preliminary Survey of Quality Functions

Standards and Specifications

- Issue General Policy
- Prepare Raw Material Specifications
- Prepare Processing Standard Methods
- Prepare Product Specifications
- Approve Specifications
- Issue Specs. and Keep Current
- Audit Specification Compliance

Purchased Materials Control

- Approve Suppliers
- Approve New Materials
- Check Incoming Lots
- Decide Disposition of Off-Standard Materials
- Contact Suppliers on Quality Problems

Process Control

- Record Process Conditions and Data
- Stop Off-Standard Operations
- Approve Deviations or Special Handling
- Make Routine Tests or Inspections
- Check Gauges, Scales and Other Controls
- Initiate Process Investigations
- Do Trouble Shooting
- Check Proposed Process Improvements

Final Quality Assurance

- Do Final Inspection and Tests
- Audit Routine Final Inspection
- Make Warehouse or Field Checks
- Check Packaging and Shipping Errors
- Report Compliance and Reliability

Complaints

- Make Field Investigations
- Check Complaint Samples and Data
- Determine Responsibility
- Determine Correction and Follow-up
- Issue Complaint and Field Quality Reports

Quality Control Methods Improvement

- Improve Inspection and Test Methods
- Improve Automatic Control or Test
- Improve QC Record and Reports
- Improve SQC for Control and Experiments
- Improve Quality Training
- Improve Coordination and Cooperation on QC

Other Quality Functions

- Test and Approve New Products
- Evaluate Competitive Items
- Encourage Employee Quality Mindedness
- Report Quality Costs, Losses and Problems
- Push Basic Quality Improvements
- Evaluate Effectiveness of QC Program

Control Department? The decision for each item must be based on a logical plan of organization, amended by the abilities of present personnel and by the need (or lack of need) for improvement of this function. Some of the writers' suggestions for assignment of specific functions to a separate quality control department are outlined below.

Assigning Responsibility

There are certain quality controlling functions that, in almost every instance, can be usefully performed by an independent and separate quality control section, which can devote its full attention to quality control and which has no primary or conflicting responsibilities for design, for production, for purchasing, or for sales. These are:

Audit and appraisal of product quality, including comparison between periods or between old and new designs, etc.

Reporting of quality conditions and problems to management, with either recommendations for improvement, or for investigations to determine means of improvement.

Summation and reporting of complaint data, to detect trends or needs for investigation promptly.

Review of new products, processes or policies which may effect quality or quality costs, as an additional and presumably impartial survey for management and departments most concerned.

Keeping informed on new developments in the technical and administrative sciences of quality controlling, particularly developments in different type operations, which may be usefully applied to the company's problems.

Training of key employees in special or new control techniques.

There are also several functions which are usually done best by a quality control department, but which may be done by other groups, depending largely upon management policy and on capabilities of individuals concerned. These include:

Working with suppliers on quality problems and methods of improvement.

Complaint investigation, including examination of samples, field trips to evaluate customer reaction, determination of complaint responsibility, and work with customer on quality problems and with company departments for improvements.

Inspection and test of incoming materials, and approval or rejection.

Inspection and test of finished product, and approval or rejection. Also the supplying of certifications or quality reports or statistical assurances to customers.

Preparation of inspection and test methods, procedures, standards, and records; including new developments in such methods for quality-cost improvements.

Making of quality investigations or "trouble-shooting" to locate causes and correction of defects or other quality problems.

EXHIBIT II

Guide to Major Quality Control Functions[1]

Function	QC	Prod.	D-D[2]	Purch.	Sales	Cost
Raw Material Specifications	a		XX	a		
In-process Specifications	a	a	XX			
Product Specifications	a	a	XX		a	
Product Visual Standards	XX	a			a	
Process Operating Procedures	a	XX	XX			
Inspection & Testing Procedures	XX	a	ca			
Quality Record & Data Systems	XX	i	i	i	i	ca
Develop Improved Materials	c	c	XX	c		
Select Vendors	a		a	XX		
Check Incoming Materials	XX			i		
Disposition of Off-standard Mtls.	XX	a	a	a		
Contact Vendors on Quality Problems	XX		c	a		
Enforce Process Operating Procedures		XX				
Make In-process Inspections & Tests	ic	XX				
Disposition of Off-Std. In-process Mtl.	a	XX	a			
Audit Procedure Enforcement & Problems	XX	i	i			
Production "Trouble Shooting"	XX	XX	ic			
Product 100% Inspections	i	XX				
Lab. & Life Tests	XX	i	i		i	
Audit Outgoing Quality	XX	i	i		i	
Investigate Complaints & Check Samples	XX	i	i		ic	
Recommend Adjustment	XX	i	i		a	i
Follow Corrective Actions re Complaints	XX	c	c		c	
Improve Quality Controlling Methods	XX	c	c	c		
Evaluate Competitive Items	XX		ic		ic	
Report Quality Conditions & Problems	XX	i	i	i	i	
Report Quality Costs & Losses	i	i	i	i		XX
Encourage Quality Mindedness & Training	XX	XX	XX	c	c	c

(1) This guide is intended only as a sample and not as a recommendation for any particular company. The legend for this guide is: xx = prime responsibility, a = approve, c = cooperates, i = informed by department responsible.

(2) Development and Design Department.

There are further quality controlling functions sometimes assigned to the Quality Control Department, but which the writers believe can usually best be done by the primary departments most concerned. In those cases where it is necessary to temporarily assign such functions to the QC group, consideration should be given to strengthening the other sections so that they may eventually assume these.

Preparation of material or product specifications. (Normally should be done by the Design or Development function.)

Preparation of production operating procedures. (Normally should be done by Production and Design working together.)

In-process inspections and tests to control production operations. (Better if Production has definite responsibility and authority, with QC auditing compliance or providing technical service to Production in making tests or helping establish control methods, etc. Except in unusual or temporary situations, the writers do not recommend that QC have the right to stop production. If the Production supervisor persists in running bad work or not following approved procedures, he should be retrained or replaced.)

Establishment of experimental programs for development or new product testing. (Best done by the Development group. QC can help train in modern statistical methods for experimental design and analysis and review work, but modern Design or Development sections should themselves be capable of understanding and using these techniques.)

Appraisal of the QC Program. (It is difficult for even the most conscientious and "research oriented" QC manager to impartially appraise the success or

shortcomings of his work. Appraisal should be on the basis of a consistent system of reporting "Quality Costs and Losses," by management evaluation, or, in some cases by an outside consultant.)

When assigning functions to a new quality control section it should be kept in mind that it is almost always better to transfer these responsibilities on a gradual basis. A timetable should be prepared and periodically adjusted as conditions dictate. In general, a good way for a moderate size company with no prior QC experience to start is to: (1) select and train a QC manager or engineer; (2) use this man (or men) on a staff basis to work first on one or two major quality problems; (3) gradually establish procedures, standards, records and reports as necessary; and (4) as confidence and experience are obtained have QC gradually assume the responsibilities of either staff or line work as management dictates.

Role of the QC Department

It must remain the basic responsibility of Development to design a good product; of Purchasing to buy from reliable vendors; of Production to manufacture to meet specifications; and of Sales to provide logical design parameters and useful field information. In addition, each of these primary departments must do this at minimum cost, and all must have a responsibility for improvement of quality at lower costs. Nothing in the quality control program and plans must detract from these primary functions.

The quality control department should better coordinate activities and provide technical assistance, but the basic obligation for proper performance of work is not relieved for any department, or for any individual, by the establishment of a quality program.

To achieve good cooperation on quality problems, it is important that other departments have respect for the abilities and impartiality of quality control. It is also important that quality control sincerely attempt to aid other departments, rather than simply police or comment on performance.

In addition, it is essential for good coordination of effort that each section understand its own functions and those of other groups. In Exhibit Number Two, a sample is shown of the shorthand form in which many companies express the relationship of quality functions and the specific responsibilities of each group. It is strongly urged that each company define its delegation of duties and authorities in some such definite fashion and supplement this with useful procedures for effective implementation of these functions.

Departmental Organizations

Organization of the QC section will depend, of course, upon the functions assigned to it, as well as upon the type of company quality problems and basic organization.

It is a prime requisite that the QC activity be able to obtain correction of quality problems. For example, if these problems are divided among Design, Purchasing and Production (as they often are), then having the quality department report to the head of any one of these may not correct problems in the other sections. If, on the other hand, the great bulk of quality problems and losses are located in the Production operation, and if they can be eliminated by corrections within that area, then there is no purpose in having quality control report to an executive whose interests and time are largely devoted to problems of Development, Sales, etc.

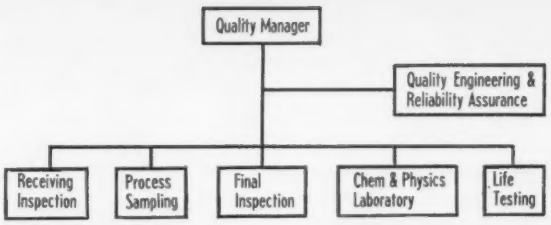

FIG. 1—Structure of a typical QC department.

The basic rules for location of the quality department, organizationally, are that it should report to the lowest level executive who: (1) can enforce corrective actions for major quality problems; (2) accurately reflects over-all management's opinion in decisions of quality versus cost; (3) is technically minded and in sympathy with modern concepts of quality control.

In most instances, in the moderate sized company, this will be the General Manager of Operations, Executive Vice-President, or similar executive.

The internal organization of the quality control department will depend upon its functions, but in general it will be divided into "line" and "staff" sections. Line sections will conduct inspections and laboratory tests. The "staff" group will be responsible for the quality engineering activities of investigation, methods preparation, planning, recording and reporting. A typical organization is shown in Figure 1.

Personnel

Detailed advice for good selection, training, evaluation and direction of QC personnel is beyond the scope of this series of articles and the reader is referred to the several books and articles covering portions of these subjects *(3, 5, 8, 9* and *10)*. However, basically, the methods for obtaining and utilizing good men in the quality controlling function are not much different from any other technical management activity. In all cases, management must understand the job requirements and then skillfully evaluate men and their ability to fill these needs.

The good quality control manager has a combination of scientific and administrative abilities and aptitudes. He is interested in costs and has a "research attitude" of looking for facts rather than trying to prove preconceived opinions. He must be able to effectively initiate, sell and follow-through programs for quality-cost improvements. He must be able to make decisions promptly after study of the available

EXHIBIT III—Job Description: Quality Control Manager

DUTIES: Install and direct a system of Quality Control for the maintenance and improvement of product quality and for the reduction of quality costs and losses. Includes:

(a) Establishment of logical procedures, specifications and standards for material, process and product control (in cooperation with other Technical, Production, Purchasing and Sales personnel).

(b) Establishment or improvement of inspection, test, and record systems.

(c) Investigation of quality problems to locate corrective actions required.

(d) Supervision of inspection and test personnel and training as necessary.

(e) Reporting to management the status of quality problems, costs and plans.

LOGICAL SOURCES: (1) Upgrade from inspection or test supervision, with plans for training and for outside advice during initial period (6 to 18 months).

(2) Hire outside, with related training and experience, with plans for training in company policies, methods, products and personnel.

LOGICAL ADVANCEMENT TO: General Management.

REQUIREMENTS FOR ADVANCEMENT: Proven record of technical and administrative abilities plus experience in company methods and problems.

AGE AND SEX REQUIREMENT: Male, minimum age 28, normally 30 to 50.

FORMAL EDUCATION REQUIRED: Technical degree or actual equivalent; prefer Ch.E. with rubber chemistry, but M.E., I.E., Chem. or Physics acceptable. (Also training in SQC required.)

CRAFT TRAINING REQUIRED: Knowledge of rubber processing and control highly desirable.

SPECIAL TRAINING DESIRABLE: Statistics (both process control and experimentation), inspection and testing very desirable.

EXPERIENCE REQUIRED: If hired outside, should have minimum of 5 years in QC supervision, at least part of this on rubber operations.

MANUAL SKILLS REQUIRED: Not applicable.

PHYSICAL REQUIREMENTS: Normal, will be in plant, examining product, etc.

SPECIAL PERSONALITY REQUIREMENTS: Will work with other dept. heads, superiors and subordinates on controversial problems, also contact customers and vendors. Must have above average personality and leadership abilities.

TESTING SUGGESTED AS AID TO FINAL INTERVIEW: No formal tests recommended, but should be carefully checked for required knowledge and personality by interviews and investigation of past record. This will include reference checks, study of work samples and technical papers, investigation among colleagues in technical societies, and perhaps appraisal by outside consultant.

facts, and admit errors when his own decisions are wrong. In a small company he is usually chosen for his own technical ability; in a large company, for his ability to lead technical men. In both cases, he must be able to effectively combine his own ideas and skills with those of many others.

In addition, he must have something we call "Quality Mindedness"—an interest in improvement, coupled with an analytical ability to evaluate quality, plus a certain doubt and demand "to be shown." We see some persons pinch a loaf of bread before buying, seek out a known brand, check carefully into the features and operation of a contemplated appliance purchase, etc. These are all common examples of the urge many persons have to be sure before buying. The quality manager must have this to a considerable degree, but exercise skill and good judgment in applying this concept.

Technical developments in recent years in such areas as statistics, automation inspection, non-destructive testing, data handling, instrumentation, process controls, and the like, have made modern quality control equivalent in complexity to the most highly skilled job in industry. The older idea that an experienced inspection foreman or laboratory supervisor can be made readily into a quality manager is optimistic, unless this man has a basic education in engineering, an interest in advanced scientific training, and both intellect and personality above average for these positions. There is no point in a company trying to train for quality manager or engineer a man whose basic abilities they would unhesitatingly reject for training to such positions as Design Engineer, C.P.A., Personnel Director or Production Manager.

Even in a modest-sized company, the total "Quality Costs and Losses" may be several hundred thousand dollars annually. The difference between a barely acceptable and an outstanding quality manager will be worth many times the difference in salaries. It is suggested that a company planning to engage a quality head select the very best man available at a salary as high as necessary, providing this does not seriously upset their salary pattern for similar levels of responsibility. In addition, the company should keep in mind that many of the most competent men in this field are interested in challenging and complex jobs at least as much as they are interested in salary. There are today many companies in the range of about 500 employees with QC managers earning $15,000 to $20,000. There are others with equally competent men earning considerably less, and well satisfied because of job interest and importance, area considerations, etc.

An example of a job description for a quality man-

ager is shown in Exhibit Number Three. This is for general interest and not suggested for any specific company, since each will differ in QC functions and thus in requirements.

Training and Advancement

Management should be alert to the importance of continual training of its quality staff and make sure these men are advancing regularly and rapidly through home study, advanced courses, attendance at technical society meetings, etc. It is the writers' belief that any company should budget at least five per cent of its technical and supervisory time for training. In addition to this time, which amounts to two hours a week or about three weeks a year, the employee should be expected to add another two to four hours a week for study, attendance at evening classes, or technical meetings. This seems about the minimum for any Quality Manager, QC Engineer, Chief Inspector, or similar person, to keep abreast of at least a portion of the advances in all phases of industrial quality control.

The man who is consistently too overworked for such study is probably in too complex a position for his organizational abilities. The man who is not sufficiently interested will eventually be replaced by one whose greater interests have led to greater abilities. The old saw about "not standing still" is as true for individuals as it is for companies, and it is even more true as one progresses up the industrial technical ladder.

It has been the writers' experience that a high proportion of employees, at all levels, are interested in training, provided: (1) their boss is interested and sets a good example; (2) training is made reasonably convenient, competent and inexpensive; (3) the training encouraged is not beyond their educational foundation and abilities; and most important of all (4) the training is really useful to their present or contemplated job.

Incentive

The same basic desires for recognition, expression and pride in accomplishment exists today that have existed through man's history. Management-union agreements for advancement based largely on seniority, industrial engineering division of jobs to reduce skills and judgement, incentive systems based solely on number of units, lack of supervisor attention to individual accomplishments and skills, plus often a basic management lack of quality-mindedness, have all contributed to reduce the natural urge of men to take pride in their work.

The executive who feels his employees lack quality consciousness should examine first his own real interest in good work, and examine second his skill in encouraging individual accomplishments. It is a tribute to the maturity of many managements that we see today a reduction in monotony of jobs, and an appreciation of the benefits of making jobs either sufficiently complex to warrant human intelligence, or else eliminating the job by automation.

Summary

No other aspect of modern quality control is as important as good selection, training, direction and encouragement of employees at all levels. It is important that the quality director and his chief assistants be selected for both technical and administrative ability and interests. It is also important that each employee, from top management to operator, understands the effect that his own job has on quality and costs and is encouraged to contribute to his full ability.

The newer technical improvements are of great help in making better products cheaper, but these techniques must still be selected and operated by people, and these men and women, their abilities and interests, are the key to improvement in every industry and plant.

Literature References

No attempt has been made to list the many fine books and articles bearing on quality control and its application to specific problems or areas. However, the following are a few selected texts which the authors believe worthy of study by the control executive and his technical assistants.

(1) Shewart, W. A., *Economic Control of Quality of Manufactured Product*, D. Van Nostrand Co., Princeton, N.J., 1931. By no means light reading, but a "must" for the career quality director and stimulating for the scientific-minded executive.

(2) Juran, J. M., *Management of Inspection and Quality Control*, Harper and Bros., New York, 1945. Largely aimed at the machine and assembly industries and unfortunately now out of print. However available in most libraries and still up-to-date in many of its ideas.

(3) Juran, J. M., *Quality Control Handbook*, McGraw-Hill, New York, 1951. Too detailed for general reading, but useful as a reference. The executive will find sections of interest on organization, quality concepts, specifications etc.

(4) McMaster, R. C., editor, *Nondestructive Testing Handbook*, Ronald Press, New York, 1959. Aimed almost exclusively at metals testing but some of these have possible application in rubber. Basic knowledge of these principles will be of interest and perhaps stimulation.

(5) Feigenbaum, A. V., *Quality Control Principles, Practices, and Administration*, McGraw-Hill, New York, 1951. A good standard description of principles and some of the methods of quality control.

(6) Schrock, E. M., *Quality Control and Statistical Methods*, Reinhold Publishing Corp., New York, 1957. Probably the best book on elementary statistical quality control for the foreman level. Sections on quality control functions, organization, and the use of statistics are easy to read and based on much practical experience.

(7) Duncan, A. J., *Quality Control and Industrial Statistics*, Richard D. Irwin Inc., Homewood, Ill., 1959. Considered by many as the best college level text on statistical methods in quality control.

(8) Dooher, M., and Marting, E., editors, *Selection of Management Personnel*, American Management Association, New York, 1957.

(9) Reynolds, E. A., "Industrial Training of Quality Engineers and Supervisors," *Industrial Quality Control*, May (1954).

(10) May, F. B., "Company Wide Quality Control Training," American Society of Quality Control, *National Convention Transactions* (1956).

Rubber-Fabric Testing Procedures

Techniques used in the selection of proper fabric for automotive air brake diaphragms have broad applications

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THE tests here described were conducted in connection with design modifications, which included new diaphragm material for six units—two emergency valves, a pressure regulator, a brake valve, a relay emergency valve, and a trailer emergency stop light switch.

One of the problems experienced with previous material was wicking—this is air seepage occurring at high pressures through the fabric of the diaphragm. What was wanted was a fabric of excellent anti-wicking properties, without loss of any of the other properties desirable for the application—strength, flexibility, and high and low temperature performance within the range—65°F. to 200°F.

Among a number of fabrics suggested by different suppliers, a nitrile rubber coated nylon fabric, specially developed for this use by Vulcan Rubber Products Division of Reeves Brothers, Inc., appeared to meet the requirements most closely. This fabric was subjected to the gamut of B-W test procedures to check the manufacturer's specifications and to ascertain its serviceability under operating conditions. It was then adopted for production.

Not a single one of the many parts used in automotive air brake systems should fail. The thin flexible fabric diaphragms used in valves and switches must be as reliable as the rigid, thicker metal parts. To assure maximum reliability, Bendix-Westinghouse subjects a fabric considered for use as a diaphragm to exceptionally severe and extensive tests. While these tests are probably more comprehensive than those employed by any other industry, they may nevertheless serve as a helpful guide to any company that wants to conduct its own tests with synthetic rubber coated fabrics before incorporating them in its equipment.

Suggested Tests

Adhesion Test. Adhesion requirements are a minimum of ten pounds per inch of width. The rubber coating is pried loose at the edge of a sample with the help of a razor blade. Coating and base fabric are then inserted in a tensile tester to register the tension needed to pull off the coating. In many cases, the samples could not be stripped, indicating the ultimate in coating to fabric adhesion.

Thread Count and Fabric Weight. These two factors can be checked after stripping of the coating. Thread count is made both in fill and warp direction. The fabric is registered in ounces per square yard.

Fabric Material. This is done by using the visual, chemical, and/or microscopic tests of ASTM Tentative Method D276.

Coating Material. The rubber is checked by flame and odor tests and is compared with known specimens to determine the general class of rubber; i.e., whether it is natural rubber, neoprene, SBR, nitrile rubber or some other type.

Oil Resistance. This is an important property in diaphragm coating, since it may be exposed to engine and lubricating oils present in compressed air. Many rubbers deteriorate in contact with oil. The samples are immersed for 70 hours in standard ASTM No. 1 and No. 3 oils at 212°F. Then the total percentage of volume change of complete diaphragm material is measured. Permissible limits for this application are —15% per cent to zero in ASTM No. 1 oil and —5 per cent to +5 per cent in ASTM No. 3 oil.

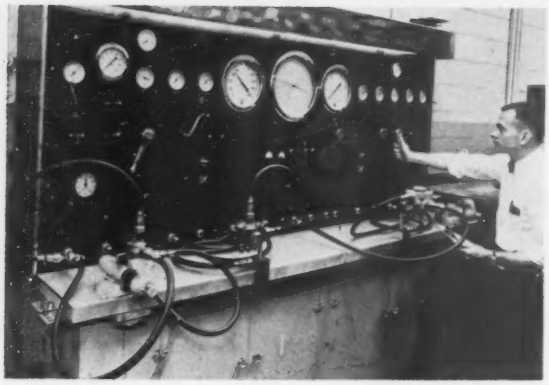


FIG. 1—Specially constructed panel permits testing air brake components at many different loads of compressed air.

In addition, samples may be subjected to a synthetic reservoir drainage. These drainings accumulate in air brake systems as the result of vapors condensing from the compressed air which includes engine exhaust fumes, polluted industrial atmospheres, etc. Bendix-Westinghouse synthesizes reservoir drainage in order to have a standard for the tests. Test samples are observed as to their volume change and the coating's resistance to the drainage which is composed largely of water and dilute complex organic acids.

Tensile Strength. (Grab tensile) is tested in a Baldwin-Lima-Hamilton Universal tester. Requirements for the application are a minimum of 250 by 275 pounds per inch.

Operational Tests. A specially constructed panel (Figure 1) with compressed air supply permits duplication of the many different air loads to which each of the air brake components may be subjected. A system of air gages, timers, counters, etc. registers every type of load and change in load. Here the diaphragms, installed in the actual units in which they are to be used, are tested as to their operational characteristics—air flow, leakage, wicking, response to differential pressure, noise, and creep. A static test prescribes operation at full pressure for several hundred hours.

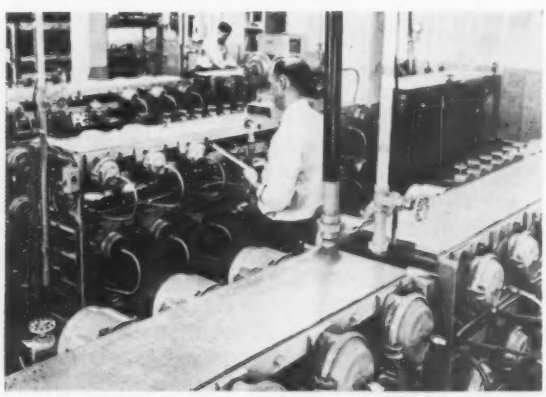


FIG. 2—Life-test room provides facilities for testing several hundred air brake units simultaneously.

Anti-wicking Property Test

Anti-wicking properties, in the instance under review, were tested with particular severity. The diaphragm that posed special wicking problems had a breather hole at a distance of ¼ inch from the outer edge, connecting top and bottom chamber of the valve. The edges of the breather hole were exposed to prolonged air pressure of 100 psi. Any seepage occurring through the fabric was detected by coating the outer edges of the diaphragm with a leak test solution. Leakage and wicking, if present, are readily observed from the frothing or foaming which occurs. The fabric selected registered a wicking rate ranging from zero to about one-fifth of that of other comparable die cut diaphragms.

Cold Box. A serious problem with diaphragms having unsuitable coating is that they stiffen in cold weather. To pass a test, diaphragm in unit must cycle satisfactorily after a minimum of five hours at —65°F. in the cold box.

Oven Test. This is of particular importance for diaphragms in governors that are mounted on compressors and exposed to the engine heat. A diaphragm must cycle satisfactorily for 600 hours at 200°F., and without showing cracks or other signs of deterioration in the coating.

Life-Test. In a special life-test room (Figure 2) providing facilities for testing several hundred experimental units simultaneously, each unit must operate for at least one million cycles at operating pressure. To pass the test, a unit and its individual parts, such as the diaphragm, must retain its full operating characteristics.

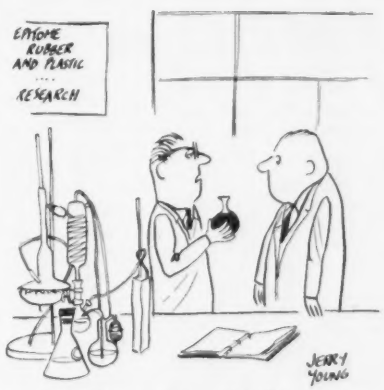
Road Tests. Finally, when all laboratory and operating tests have been completed satisfactorily, new devices undergo extensive field tests on controlled vehicles. Efficient trucking operators who keep accurate records cooperate in these tests. To pass a field test, a unit must operate trouble free for approximately 100,000 miles on the road—a test that may take many months, and often up to two years to complete.

Only after this final hurdle has been passed by a new material, will it be specified and used in regular B-W production.

Every new shipment of diaphragm material received against established B-W specification undergoes a number of routine control tests — including adhesion tests, analysis of coating and base fabric, gage weight—to make absolutely sure that no mistake has been made in the delivery and that the very same material is used in regular production that has been so carefully tested in the development stage.

EDITORIAL

Defining the Issues



"I can't decide if it is a rubberlike plastic or a plasticlike rubber!"

► It is now almost four years since Subcommittee 8 on Nomenclature of ASTM Committee D-11 on Rubber and Rubberlike Materials undertook the preparation of a definition for rubber and rubberlike materials. Activities of Subcommittee 8 during this time have resulted in much that is good and fruitful. There has been a stalemate, however, in the evolution of a workable definition for "rubber" and "rubberlike." In recognition of the stalemate, Subcommittee 8 has entered upon a re-evaluation of its scope and a review of past and future activities. This is all well and wisely undertaken, but we respectfully suggest that the issue involved is not a re-evaluation of scope, but a facing up to the realities of the situation. Why the stumbling block to acceptable definitions for rubber and rubberlike?

We are of the opinion that the American Society for Testing Materials is a technical and scientific organization. As such, it should concern itself with technical and scientific matters. Technical definitions are not always easily arrived at or agreed upon by all concerned. When these definitions are based upon scientific knowledge, an area of agreement is usually found. When scientific definitions are coupled with front office definitions, difficulties arise which may never be reconciled.

There is no attempt here to disparage the aspirations of either the front office or the laboratory. The front office must face up to economic facts of life and concern itself with tariffs, interstate commerce, fire regulations, etc. An overly restrictive definition may place intolerable burdens upon the conduct of profitable business and, in the extreme, can even force the removal of a product from the market.

Technical people, on the other hand, require different tools. The question now revolves about whether or not the goals of the two groups are beyond reconciliation, or whether there is a common meeting ground. The experience of the past three years or so inclines us to the belief that there is probably little possibility that both sides will ever be satisfied. The end result of such a "shotgun wedding" would be so watered down and so ambiguous as to be unworkable to both sides.

We come now to a conclusion which does not have the proverbial happy ending. Certainly, it is little comfort to acknowledge that the problem is not unique and is, in fact, but one result of the dynamic interplay of forces in a free society. We do feel, however, that a facing up to the realities of life is healthy and may serve in some oblique way, not to solve the problem, but to give each of us a better understanding and a better respect for opposing viewpoints.

How to Compliment Your Employees

By H. E. CARROLL
El Cerrito, Calif.

► Compliments have been described as verbal vitamins to give employees an added lift. As you use compliments in dealing with people under your supervision in your rubber plant, you will find that these compliments are powerful stimulants to get better cooperation.

There are three types of compliments you can use in dealing with your employees: (1) First person, (2) Second person, and (3) Third person.

First person compliments are those you give directly to your employees. You come right out and make a sincere compliment to the employee. For instance, here are a few examples of first person compliments:

"You have the highest production record in the plant."

"I am mighty proud of your safety record."

"I wish everyone had as many good ideas as you suggest."

Second person compliments are at times more effective than the direct type. In this type of compliment, you "pass along" words of praise. It is often more believable and gets completely away from flattery. Here are a couple of illustrations of this type of compliment:

"The front office was bragging to me about your safety record."

"Jim was telling me how you . . ."

To use second person compliments successfully, you need to be attentive to all compliments others give those under your supervision. Then, you casually "pass along" the verbal vitamins to the employee for an effective compliment.

Third person compliments can be most effective in dealing with employees under your supervision. You have an opportunity to "bank" your compliments and get more cooperation from two people instead of one as with most compliments.

For instance, you might say to Bill: "Jim sure turned in a swell suggestion the other day." Bill in turn passes the compliment along to Jim. They both feel good—Bill because he has a compliment he can pass along and Jim because he receives a compliment.

When you use the third person compliment, be sure you are not knocking the person you want to pass along the compliment. For instance, if you had said to Bill: "Jim is the best man in the department," it might boomerang. Bill might think you are telling him he is no good. Here are some rules successful executives follow in passing out verbal vitamins:

Rule 1—Don't flatter—compliment.

Flattery is insincere. To make your compliments most effective, you need to believe what you say. Be sincere. Base your compliments on facts and you will have an honest, sincere compliment.

Rule 2—Turn doubts into compliments.

Complimenting Miss America on her beauty would not be a strong compliment. Or, complimenting anyone on anything of which they are sure is not good strategy. But, you can pack power into your verbal vitamins when you compliment a person on something he doubts.

For instance, one of the men in your department comes to you about an idea for a change in production. You can tell whether or not he has a doubt by the way he presents his suggestion. If there is any doubt in his mind, you have a wonderful opportunity to compliment the employee on his well-thought-out suggestion, his loyalty to the plant, or on his creative powers.

Rule 3—Be specific in your compliments.

Single word compliments are weak. For instance, words like "swell," "fine," "wonderful," and "good" are not the most effective compliments. They are not specific and hence lack the power of a good verbal vitamin.

You give your verbal vitamins more power when you are specific. For instance, instead of saying, "You have a fine safety record," you make your compliment more specific by saying, "Six years without an accident is a safety record to be proud of."

When you compliment an employee on his production record—repeat the figures of the record. When you compliment a man on a suggestion—repeat the suggestion as specifically as possible. Thus, you will make your compliment more believable and take it out of the "flattery" classification.

Rule 4—Use comparative compliments.

Superlative words like "most" or "best" are apt to be taken as flattery by the employees you are complimenting. Then, too, you will find that when you use the comparative form of the compliment (more or better), you can do it again and again. Something that is the "best" or the "most" is just that—no chance for improvement. There are other ways you can use the comparative form in your compliments. You might say:

"This is the best I have ever seen..."

"That looks like one of the most effective suggestions that has been submitted."

You can use the superlative form if you compare it with something. For instance, the first example cited compares the "best" with your past experience. The second example compares it through the use of "one of the most" to qualify the superlative statement.

Rule 5—Have plenty of variety

Verbal vitamins need to have variety. Repeating the same compliment day-after-day to the same employee will be a boomerang. You need to add variety to your compliments to keep them on the believable level. And, as you know, it is mighty hard to be sincere about the same thing time-after-time.

You can compliment your employees on their attendance, performance (broken down into specific tasks), safety, ideas, outside achievements (sports, offices, etc.), and service with the company. A little searching will reveal plenty of things your employees do that can be complimented honestly and sincerely.

Another way to add variety to your verbal vitamins is to vary the method used. Today give a first person compliment, tomorrow make it second person, and the next day try a third person compliment.

Successful supervisors give plenty of compliments to their employees. They know these non-financial verbal vitamins improve morale, increase cooperation, and get more accomplished in any plant.

SPECIAL INDUSTRY REPORT

ASTM Committee D-11 Meets in Cincinnati on February 1-3

► Committee D-11 on Rubber and Rubberlike Materials, of the American Society for Testing Materials, and 17 of its subcommittees met on February 1 to 3 at the Netherland Hilton Hotel in Cincinnati, Ohio.

Robert D. Stiehler (Bureau of Standards), chairman of the American Group of ISO/TC 45 on Rubber and Rubber Products, informed Committee D-11 that the following ISO recommendations relating to rubber have been issued, and are available from the American Standards Association: R123—Sampling of Latex; R124—Determination of Total Solids of Latex; R125—Determination of Alkalinity of Latex; R126—Determination of Dry Rubber Content of Latex; R127—Determination of KOH Number of Latex. Dr. Stiehler reported that the next meeting of ISO/TC 45 will be held in Milan, Italy, during the week of May 8 to 13, 1961.

John Mandel (Bureau of Standards), chairman of Subcommittee 28 on Statistical Quality Control, presented a technical paper on "Interlaboratory Studies of Test Methods." Mr. Mandel pointed out that the design of an interlaboratory study must be simple and flexible. Elaborate statistical designs are often highly vulnerable to the loss of even a single observation. In addition, their validity also depends on a number of assumptions that do not always hold in individual cases.

According to Mr. Mandel, the basic design of a sound interlaboratory study of a test method involves nothing more than a collection of laboratories, a number of materials covering the range of interest, and the proviso that each laboratory measure each material more than once. The paper, in effect, was an introduction to work being undertaken by Committee D-11 in the development of a recommended practice on the planning of interlaboratory test programs for rubber.

John Mandel (Bureau of Standards), chairman of Subcommittee 28 on Statistical Quality Control, presenting his paper on "Interlaboratory Studies of Test Methods."

A brief report on "The Need for a Standard Method for Oil Aging of O-rings" was given by H. G. Gillett (Precision Rubber Products). As a result of the discussion which followed this presentation, a task group was appointed, within Subcommittee 6 on Packings, to develop a method for immersion testing of O-rings. The task group also will consider the preparation of specifications for O-rings.

It was proposed that R. H. Monet and W. I. Martin (Koppers Chemical) be asked to present a paper at the D-11 Annual Meeting on the subject of "Statistical Evaluation of Factors Affecting Adhesion of Cord-to-Rubber." The proposal was referred to H. G. Bimmerman (DuPont), vice-chairman of D-11, for action.

The next meeting of Committee D-11 and its subcommittees will be held on June 27 to 30, 1961, at the Chalfonte-Haddon Hall, in Atlantic City, N. J., during the 1961 Annual Meeting of the American Society for Testing Materials.

Activities of the D-11 subcommittees follow:

Subcommittee 5—Insulated Wire and Cable (John T. Blake, Simplex Wire & Cable Co., chairman): Interim reports were given by task groups on such work as temperature correction factors for polyethylene; correlation and simplification of test conditions; classification of rubber compounds; new specifications for polyvinyl chloride compounds, and revisions of polyethylene and silicone rubber specifications. The subcommittee expects to have this work finalized by the June meeting.

Subcommittee 6 — Packings (R. F. Anderson, B. F. Goodrich Co., chairman): D-1147-56T (Compressability and Recovery of Gasket Materials) was reviewed and revised. The revisions will be submitted to D-11 for letter ballot. A task group report on a proposed tentative ASTM specification for rubber rings for asbestos cement pipe was submitted by Dr. Axelson (Johns-Manville). Several revisions were made and the tentative specification will be submitted for letter ballot. A sealability procedure developed in Section 10 of Tech Committee A will shortly be submitted to D-11 for consideration as an ASTM method. Mr. D'Olier (Rabestos-Manhattan) will lead the discussion at the next meeting of the subcommittee. A discussion on cyclic compressive stress relaxation and sealability was held, and a study will be made to coordinate the activities of several committees interested in these subjects.

Subcommittee 8 — Nomenclature and Definitions (R. G. Seaman, Rubber World, chairman): The chairman reviewed the action taken at the June, 1960, meeting, at which time definitions for "rubber", "rubber-like" and "rubber products" were approved for submission to the ASTM Administrative Committee on Standards for inclusion in D-1566-58T (Terms Relating to Rubber and Rubber-Like Materials). The Administrative Committee accepted the definitions for "rubber" and "rubber products" and rejected the definition for "rubber-like." The definitions for "rubber" and "rubber products" were reviewed by the D-11/D-20 Joint Task Group on Definitions, at a meeting on December 9, 1960, and a further revision for the definition of "rubber" was made. In addition, a definition for "elastomer" was proposed for consideration by both D-11 and D-20. H. G. Bimmerman (DuPont) presented the previous and revised definition for "rubber." The subcommittee voted to replace "polymeric" with "elastomeric" in the D-11/D-20 definition, and to accept the joint definition for "elastomer" as written.

W. H. Watson (Polymer Corp.) presented a proposal for changing the per cent retraction after extension in the "rubber" definition from 10 to 50 in order to include new rubber materials that would otherwise be classified inaccurately as plastics. After considerable discussion, the subcommittee voted to make this change. The definitions and revisions will be submitted to D-11 for letter ballot.

The subcommittee, after discussion, voted to review the terms listed in the 1956 Glossary of Terms Relating to Rubber and Rubber-Like Materials and offer for inclusion in D-1566-58T only those terms pertinent to Committee D-11 work.

R. D. Stiehler (Bureau of Standards) recommended that the following codings for elastomers in the "M" or polyethylene family be made part of D-1418-58T (Recommended Practice for Nomenclature for Synthetic Elastomers and Latices): IM —polyisobutene; EPM—ethylene-propylene copolymer; CSM — chloro-sulfonyl-polyethylene; CFM—polychlorotrifluoro-ethylene; FPM—copolymer of vinylidene fluoride and hexafluoropropylene; ACM—copolymer of ethyl acrylate and 2-chloroethyl vinyl ether; ANM—copolymer of ethyl or butyl acrylate and acrylonitrile. This recommendation will be submitted to D-11 for letter ballot.

A resume of the work of Subcommittee 8 since June, 1957, was distributed by the chairman.

Subcommittee 9—Insulating Tape (W. H. Meade, Boston Edison Co., chairman): There was considerable discussion on proposed additions of moisture resistance requirements to D-1373-57T (Ozone Resisting Rubber Insulating Tape). The tentative test limits which were established will be letter balloted in the subcommittee prior to the June meeting.

The proposed specification for Butyl Rubber Insulating Tape was discussed in some detail. Tentative test limits were suggested for the various physical and electrical characteristics. It was agreed that some of the manufacturers would produce butyl rubber tapes that would be subjected to various tests. From the results of these tests it is hoped that better information will be available with which to establish tentative limits.

Tack and adhesion tests in D-69-57T (Friction Tape for General Use for Electrical Purposes) were discussed, but no action was taken.

Subcommittee 10—Physical Testing of Rubber Products (L. V. Cooper, Firestone Tire & Rubber Co., chairman): Action was taken on several methods with the following results: D-1456-57T (Strain Testing of Vulcanized Rubber) was advanced to a standard, and D-575-46 (Compression-Deflection Characteristics of Vulcanized Rubber), D-675-58T (Indentation of Rubber by Means of a Durometer), D-1390-56T (Stress Relaxation of Vulcanized Rubber in Compression), and D-1415-56T (International Standard Hardness of Vulcanized Natural and Synthetic Rubbers) were retained as tentatives. D-395-55 (Compression Set of Vulcanized Rubber) was made a tentative revision of a standard.

D-412-51T (Tension Testing of Vulcanized Rubber) was made a revised tentative method and given the new designation of D-412-61T. There were objections to a modification of this method to allow for tensile parts at higher temperatures. The revised method will be sent to D-11 for letter ballot.

The results obtained in a compression set-deflection study brought about three actions: a request that William H. King (Acushnet Process) put the report in suitable shape for publication; that 25 per cent deflection be specified in D-395-55, and that the modified method be submitted to D-11 for letter ballot.

Dr. Stiehler (Bureau of Standards) reported on the work of his task group on the comparison of D-1415-56T with the micro hardness test now being balloted in ISO/TC 45. Since the two methods showed reasonable agreement, the task group was instructed by the chairman to prepare a modification of D-1415-56T to include the micro hardness test.

Subcommittee 11—Chemical Analysis of Rubber Products (W. P. Tyler, B. F. Goodrich Co., chairman): On the basis of returns from a questionnaire and discussion at this meeting it was voted to propose to Subcommittee 12 and presumably to ISO/TC 45, Working Group A, that the currently accepted macro-Kjeldahl method for determination of nitrogen be reviewed.

A testing procedure for the determination of free MBT in MBTS was submitted by the task group on rubber chemicals. It will be submitted to D-11 for letter ballot, subject to approval by subcommittee letter ballot.

A proposed tentative method for specific gravity of rubber chemicals was discussed. John E. Smith (J. M. Huber) convinced the subcommittee members present that the method does not measure apparent specific gravity of materials in rubber. He withdrew his negative vote with the stipulation that the scope of the proposed method be altered to be consistent with the facts and that the subcommittee actively study another method of determination of apparent specific gravity of rubber chemicals when incorporated in vulcanized or unvulcanized rubber. The subcommittee agreed to this stipulation.

A task group met immediately after the meeting to discuss methods for determination of preservatives in natural rubber latex. The methods discussed will be recommended to Subcommittee 7 for consideration. This task group also agreed on the necessity of formally requesting assistance from Subcommittee 28 on definitions and statements of repeatability and reproducibility values for methods of chemical analysis.

Subcommittee 12 — Crude Natural Rubber (L. G. Mason, B. F. Goodrich Co., chairman): The results of the D-11 letter ballot on the revision of D-1278-58T (Chemical Analysis of Natural Rubber) were given. There were 99 affirmative votes and 1 negative vote, with 73 members not voting. The negative vote, which objected to the use of a porcelain crucible for the determination of copper and manganese, was resolved by an editorial revision specifying the use of only a new smooth silica or Vycoor crucible for these determinations and with the understanding that Dr. Tyler (Goodrich) would appoint a task group to further study the use of porcelain crucibles for the determination of copper, etc.

The international interlaboratory cross-check on the physical testing of eight different curing rate natural rubbers lacks reports from six laboratories in Europe, one in the Far East, and one in the United States. The present data will be analyzed so that a preliminary report can be made available for the ISO/TC 45 meeting in May.

The chairman read a letter from Dr. J. Le Bras of the French Rubber Institute regarding samples of MT-60, a specially prepared rubber, which have been received for evaluation. This rubber was reported to be fast curing and tests by Goodrich in the ASTM No. 1A recipe confirm this. Results of tests by other laboratories in this country will be awaited before reporting to Dr. Le Bras.

H. C. Bugbee and Ralph F. Wolf (Natural Rubber Bureau) reported on the work being done by the Bureau of keeping American consumers of natural rubber advised as to the latest developments from the research laboratories of the Natural Rubber Producers Research Association. An attempt is being made to develop oil-extended and oil-extended black natural rubber masterbatches. Samples may be available within a few months. Mr. Wolf stated that technically classified rubber in any grade would be made available if demand was present. He also was in favor of purchasing natural rubber to agreed upon physical and chemical test specifications rather than the present color and appearance specifications.

The scope of the task group under Ian Patterson (Goodyear), on Chemical and Physical Tests for Natural Rubber was extended from the present No. 1 RSS and No. 1 Pale Crepe to all grades of natural rubber. It was pointed out that the copper and manganese limits, while satisfactory for the smoked sheets and pale crepes, are not considered to be very realistic for the lower grades as specified in the International Specifications.

The RMA Crude Rubber Committee has requested the subcommittee's liaison contact, C. J. Glaser (Lee Rubber) to head up a task group to work on the problem and make recommendations on the storage and coating of type samples which will insure the character and color of the type sample remaining as constant as possible.

Subcommittee 13—Synthetic Elastomers (B. S. Garvey, Pennsalt Chemicals Corp., chairman): E. J. O'Connor (Goodrich-Gulf) chairman of Task Group 2 on Chemical Tests, reported that three of the four negative votes cast in the subcommittee letter ballot on the test method for determination of color of raw rubber were resolved by editorial changes. The method will be submitted to D-11 for letter ballot. The subcommittee made several editorial changes in method D-1417-57T (Testing of Synthetic Rubber Latices).

The subcommittee passed a motion that ASTM work on synthetic rubber latex should be retained in a task group of Subcommittee 13. The motion was in accordance with a recommendation made by the synthetic rubber producers and agreed to by the D-11 Advisory Committee.

It was agreed that the following note addition to D-1419-60T (Description of Types of Styrene-Butadiene Rubbers and Butadiene Rubber Latices) be submitted to D-11 for letter ballot: "Oils described as Types in Table II can be tested by the following methods: D-92 (Flash Point); D-97 (Pour and Cloud Point); D-88 or D-445 (Viscosity); D-611 (Aniline Point); D-972 (Volatile Matter); D-974 (Neutralization Value); D-1298 (Specific Gravity); D-1500 (Color)."

The chairman reported that the D-11 Advisory Committee, with the consent of ASTM headquarters, has approved the addition of new assigned numbers for SBR solid rubbers and latices, respectively, to D-1419-60T and D-1420-60T (Description of Types of Styrene-Butadiene Rubber and Butadiene Rubber Latices).

The chairman reported that the subject of assignment of SBR numbers has been questioned by two member nations of ISO/TC 45. The subcommittee recommended that the chairman appoint a task group for the purpose of setting up ground rules for the assignment of SBR numbers, and to consider numbering systems.

Subcommittee 15—Life Tests for Rubber Products (G. C. Maassen, R. T. Vanderbilt Co., chairman): The subcommittee reviewed several tentative methods and decided that the following methods be retained as tentative: D-749-43T (Calibrating a Light Source Used for Accelerating the Deterioration of Rubber); D-750-55T (Resistance to Accelerated Light Aging of Rubber Compounds); D-1206-52T (Resistance to Aging of Vulcanized Rubber by Measurement of Creep).

G. N. Vacca (Bell Laboratories), chairman of the Task Group on Oven Aging, reported on the round robin tests using tubular (Apex) oven. Results of tests in this oven are more nearly duplicable than are tests run in ovens currently specified. Mr. Vacca submitted a proposed tentative specification encompassing the tubular type oven and method of test therein. It was moved, seconded and passed that this tentative method of test for tubular oven aging of elastomers and plastics be submitted to Subcommittee 15 and to D-11 for simultaneous letter ballot. Subsequent submission would then be made to ASTM Committee E-1 on Methods of Testing for approval of the oven. D-573-53 (Accelerated Aging of Vulcanized Rubber by the Oven Method) will remain in its present status as a test method until these actions have been completed, at which time a review of the method may be necessary.

Left to right: John J. Allen (Firestone), D-11 secretary, Simon Collier (Quality Control Consultant), D-11 chairman, and Paul Smith (ASTM Staff) discussing the D-11 subcommittee reports.

The subcommittee made several editorial changes in the following methods: D-1171-57T (Weather Resistance Exposure for Automotive Rubber Compounds); D-518-57T (Resistance to Surface Cracking of Stretched Rubber Compounds), and D-572-53 (Accelerated Aging of Vulcanized Rubber of the Oxygen-Pressure Method).

The chairman informed the subcommittee that, upon recommendation of the D-11 Advisory Committee, abrasion tests will now be under its jurisdiction. This will also conform with ISO/TC 45 procedures.

Subcommittee 16 — Classification and Specifications of Rubber Compounds (J. F. Kerscher, Goodyear Tire & Rubber Co., chairman): Discussion was held on the proposed method in ASTM D-2000-SAE 200J (Classification System for Elastomeric Materials for Automotive Applications). A representative of the Enjay Chemical Co. reported that his company was in agreement with the system, in principle, but had two reservations: first, it was felt that the compression set requirements in Table VI for BA compounds are too strict; second, the company felt that there should be no suggestion as to what polymer is used in any call-out where it might, in any way, be construed as having official status.

Dr. Stiehler (Bureau of Standard) made a formal complaint against the using of aging and swell for determining the prefix and then adding suffixes to modify these same properties. He felt, and had support from several members, that one determination for these two properties should be sufficient. He pointed out that this duplication may possibly be a major block to its adoption by ISO.

The subcommittee requested the authors to provide an explanation of why they set up the system in its present form. There also was a request for more examples, particularly of some of the less standard call-outs to try to familiarize more people with the system and remove some of the confusion and reservations held by many. The chairman suggested that perhaps this could be accomplished by publicity in the rubber trade journals.

Subcommittee 20—Adhesion Tests (H. H. Irvin, Marbon Chemical Division, Borg-Warner Corp., chairman): The Lord Conical Test was discussed. While it was concluded that the test was sufficiently promising for further investigation, more time is necessary for study by the membership before consideration of any extensive work. Mr. Frye (Inland Mfg.) and Mr. DeCrease (Hughson Chemical) will arrange some testing whereby the significance of at least two diameters might be considered in the results obtained. Mr. Frye will also try to have a progress report at the next subcommittee session on dynamic test results involving the conical sample.

Discussion was held on D-429-58 (Adhesion of Vulcanized Rubber-to-Metal) concerning angle of pull variation and pre-environmental exposure standardization. Further data will be gathered through voluntary testing by individual members. This data will be used as a guide to further discussion.

The reaction to changing D-429-58 to comply with Federal Standard 601 Method 8031 was negative. Full explanation is to be sent to Don Pratt (Bureau of Ships).

Mr. Brams (Dayton Chemical) suggested that more emphasis be directed toward standardization of methods for determining bond values of actual production parts. This was well received. It was agreed that the members should be leaning more toward specification work so that blueprints might start to cover this aspect. More discussion will be held at the next session.

Subcommittee 21 — Testing of Rubber Cements and Related Products (J. F. Anderson, B. F. Goodrich Co., chairman): Special meetings of Task Group 2A on Textile Cord Adhesion and 2B on Wire Cord Adhesion were held in Detroit on November 10th, 1960, making a total of four meetings for each of these task groups during 1960, as was also the case in 1959.

George Harrison, chairman of Task Group 2A, reported that a specialized version of the "H" pull test faces its fifth revision and will be ready for letter ballot in the subcommittee and D-11 prior to the

June annual meeting. Mr. Harrison asked C. W. Beringen, M. C. Bullock and R. H. Monet to work with him in listing and illustrating methods considered for standard dynamic test methods.

R. H. Hertzog (J. A. Roebling's Sons), chairman of Task Group 2B, reported that after 21 months of extensive round-robin testing with various molds, pullout tests with two types of molds are ready for standardization after a few editorial revisions. A letter ballot will be conducted in the subcommittee, then a subsection will resolve any problems prior to submitting a two-part method to letter ballot in D-11.

Other business included a report by R. E. Dix (C. R. Lupton), chairman of Task Group 1 on Structural Adhesives and Non-Destructive Testing. Mr. Dix correlated the progress of Subcommittee 8 of SAE with Subcommittee 21 on methods for development of testing brake lining adhesion. This correlation is considered expedient for the good of all.

It was recommended that D-1205-59T (Testing Adhesives) be advanced to standard, there being no changes contemplated, and that D-553-42 (Viscosity and Total Solids Content of Rubber Cements) and D-816-55 (Testing Rubber Cements) be retained as standard.

Subcommittee 22 — Flexible Cellular Materials (L. A. Wohler, Firestone Tire & Rubber Co., chairman): The matter of advancing D-1055-58T (Test for Latex Foam Rubbers), D-1056-58T (Test for Sponge and Expanded Cellular Rubber Products) and D-1564-58T (Flexible Urethane Foam) from tentative to standard was discussed and it was the opinion that these should remain tentative to allow for more experience with the new codes.

The main topic of discussion arose concerning a request from Lester H. Spear (Blocksom) for aid in curled hair testing and specifications. The industry was also represented by Paul H. Young, Jr. (Armour). Mr. Allen (Firestone) pointed out ASTM's position, and that work could preferably be done in Subcommittee 22 if a group of interested and informed people from the industry became members of the subcommittee and assisted in the work. Mr. Spear and Mr. Young will organize such a group and contact the subcommittee chairman.

Subcommittee 24—Rubber and Rubber-Like Coated Fabrics (K. L. Keene, U. S. Rubber Co., chairman): The subcommittee voted to retain D-815-47 (Hydrogen Permeability of Rubber-Coated Fabrics) as a standard test method without revision.

Howard Bryan (DuPont) gave a progress report on methods for measuring the cold crack resistance of coated fabrics. He indicated that additional work must be done before a method can be recommended.

A progress report was submitted by the chairman covering the activities to date on the work of investigating the Tabor method of abrasion tests. He reported that results to date are inconclusive and further work is being planned. Mr. Norton reported that ASTM Committee D-13 on Textile Materials is considering an accelerator unit for determining abrasion resistance. He presented a brief description of the unit and agreed to test some coated fabric on it.

B. S. Garvey (Pennsalt), chairman of Subcommittee 13 on Synthetic Elastomers, making his subcommittee report.

Subcommittee 25 — Low Temperature Tests for Rubber and Rubber-Like Materials (R. S. Haverhill, St. Joseph Lead Co., chairman): W. H. Bryan (DuPont), chairman of the task group on Low Temperature Coated Fabric Tests, reported that the results obtained on tests of four coated fabrics, using different equipment, showed considerable variation which indicates the need for further study of such factors as speed and clearance.

Several editorial changes were made in D-1053-58T (Measuring Low Temperature Stiffening of Rubber and Rubber-Like Materials by Means of a Torsional Wire Apparatus) and the subcommittee recommended that the method be advanced to standard.

The subcommittee voted to retain as standard D-599-55 (Physical State of Cure of Vulcanized Rubber) after several editorial changes were made.

It was voted to retain as tentative D-736-54T (Low-Temperature Brittleness of Rubber and Rubber-Like Materials) since some early specifications still call for it. However, the subcommittee recommended that it be replaced by D-746-57T) (Brittleness Temperature) of Plastics and Elastomers by Impact) on all new specifications.

The subcommittee also voted to retain as standard without change D-1229-55 (Low-Temperature Compression Set of Vulcanized Elastomers).

Subcommittee 26—Processability Tests (Rolla H. Taylor, Scott Testers, Inc., chairman): J. F. Kerscher (Goodyear), chairman of Task Group 4, reported that the task group still finds differences in extrusions using the No. 1 extrusion die (Garvey type) with different extruders. However, the group fully expects to account for these differences by the June meeting and have definite proposals for a test procedure.

N. O. Sweenes, chairman of Task Group 5 on Shrinkage, reported that the work appears to have been completed, and that methods of determining shrinkage of both raw polymer and compounded rubber are now ready for submisison to subcommittee letter ballot. The subcommittee agreed that, in general, the methods were in order. However, it was suggested that the two procedures be combined and the one for compounded stock be made as broad as practical to include production type stocks. The chairman was authorized to appoint a task group to combine the two methods and to make editorial changes necessary to write the proposed method so that it conforms to ASTM practices. Mr. Sweenes, Frank Roth (Bureau of Standards) and B. S. Garvey (Pennsalt) were appointed to this task group.

George Decker (Monsanto), chairman of Task Group 1, reported on the progress of the group assigned the task on investigating the effect of holding pressures on Mooney viscosity results. Work to date indicates other variables may be much more important than holding pressure. The group hopes to have definite recommendations by the June meeting.

Subcommittee 28 — Statistical Quality Control (J. Mandel, National Bureau of Standards, chairman): The chairman reported that Subcommittee 11 on Chemical Analysis of Rubber Products has requested Subcommittee 28 to define repeatability and reproducibility in connection with precision statements of test methods. Since ASTM Committee E-11 on Quality Control of Materials is considering this matter, Mr. Mandel will discuss this question with E-11 prior to making definite recommendations.

The subcommittee voted to retain as tentative D-1421-56T (Interlaboratory Testing of Rubber and Rubber-Like Materials), and the chairman was instructed to appoint a task group to make recommendations for revision.

Subcommittee 29—Compounding Ingredients (A. E. Juve, B. F. Goodrich Co., chairman): The Task Group on Development of a Test Recipe and Method for Testing Carbon Blacks in SBR reported that further work is being undertaken to develop a procedure or a recipe less sensitive to uncertain content of carbon black.

Dr. Sweitzer (Columbian Carbon) reported on the progress of his task group's problem of developing methods for the measurement of degree of pigment dispersion in rubbers. Preliminary work by this group indicates that the prospects are good for developing both a quick and simple procedure and a more refined and more quantitative method for this measurement on vulcanized specimens. However, additional work is required to resolve differences in both procedures between laboratories before methods can be written. Also, additional work is required with respect to unvulcanized specimens.

The task group working on a masterbatch procedure for mixing the test recipe in D-1522 (Testing Carbon Blacks in Rubber) reported that three different techniques were composed in a round-robin test, and that all three gave satisfactory results although with no improvement in reproducibility. However, mixing time was reduced and the opinion was expressed that in daily operation the masterbatch technique could be expected to be more reproducible. A little additional work is required before a definite recommendation can be made.

Mr. Knill, (Goodyear), chairman of the task group assigned to consider certain objections expressed by Enjay Chemical Co. to the procedures incorporated in D-1522 for the two butyl rubber recipes, reported that a recommendation to solve these difficulties would soon be made.

Mr. Maassen (R. T. Vanderbilt), work-

ing on a re-write of D-1522, suggested that his present version, amended to incorporate the last change in D-1522, be submitted to the subcommittee for letter ballot.

Technical Committee on Automotive Rubber (W. J. Simpson, Chrysler Corp., chairman): The work of several sections has resulted in the following Tech A letter ballots, which have been forwarded to SAE and ASTM members: A Latex Dipped Goods Specification and Method of Test; Modifications of SAE-10R Table VI on Polyacrylates; a Specification for Automotive Air Conditioning Hose; a Method of Test for Urethane Foam and Changes in the Vinyl Foam Specification to include Flammability.

K. Miller (General Tire), chairman of Section 15 on Automotive Suspension Bushings, reported favorable progress on designing and building a new bushing test unit. S. M. Sidewell (Chrysler), chairman of the Subsection on Ozone, reports that the subsection has completed its work on the comparability of ozone chambers and has presented recommendations to ASTM D-11 Subcommittee 15 on Life Tests for Rubber Products.

C. S. Coddington (Gates Rubber), chairman of Subsection 3B on Coolant Hose, reported that contemplated changes in SAE-20R (Heater Hose) are in progress. R. C. Pocock, chairman of Section 9 on Automotive Hydraulic Brake Cups, has prepared a brake boot specification which is now being revised in form. Work on stroke testing equipment and a standard test fluid for cup testing are in progress.

R. C. Water (GMC), chairman of the Oil Seal Section, is reviewing a seal specification and SAE-110-R (Oil Leakage Test). Mr. Kapps (F. D. Farnam), chairman of the Gasket Section, is resigning. This section is revising D-1170-58T (Nonmetallic Gasket Materials for General Automotive and Aeronautical Purposes) and remaining active in several fields of gasketing.

Tire Unit In Ecuador

► General Tire & Rubber Co., Akron, Ohio, will be the principal stockholder, in partnership with a group of Ecuadorian investors, in a new firm to be called the Ecuadorian Rubber Co. The new company plans to construct a tire manufacturing plant at Cuenca, in southern Ecuador, which will produce 40,000 tires annually. Capacity eventually is expected to reach 100,000 tires annually, including some exports. Ecuador's annual rate of consumption is now about 55,000 units. Initially, the new firm will import raw rubber for its production needs, but it hopes eventually to be able to utilize the rubber grown locally in the Oriente region. Development of local production would be the basis for a new industry, including the cultivation of natural rubber, and its processing for use by the tire plant and possibly other local industries.

W. F. Jordan

C. A. Hill

Firestone Synthetic Names Two

► W. F. Jordan and C. A. Hill have been named vice-presidents of the Firestone Synthetic Rubber & Latex Co., Akron, Ohio. Mr. Jordan, formerly sales manager, will be in charge of synthetic rubber sales, and Mr. Hill, previously general production manager, will be in charge of all synthetic rubber production.

Mr. Jordan is a graduate of the Massachusetts Institute of Technology with a B.S. degree in chemical engineering. He also received his master's degree from M.I.T. He joined the Research Division of Firestone in 1937. In 1938 he worked in the development laboratory of the company's Fall River, Mass., plant, and returned to Akron in 1945 as a sales representative for the Firestone Industrial Products Co. Later, he served as manager of the Latex and Adhesive Division of Firestone Industrial Products and as sales manager of the Latex Division. In 1955 he was named sales manager for Firestone Synthetic Rubber.

Mr. Hill is a graduate of the University of Illinois where he received a B.S. degree in commerce. Prior to joining Firestone in 1942, he was associated with the petroleum industry and was engaged in early studies of synthetic rubber chemicals and processes. His first Firestone assignment was as supervisor of construction for the Government's synthetic rubber facility at Baton Rouge, La. Later, he joined the management staff at the Port Neches, Texas, synthetic rubber unit, which was operated by Firestone during World War II. In 1945 he became manager of the synthetic rubber plant operated by the company at Lake Charles, La. He was transferred to Akron in 1951 as general manager of the Akron and Lake Charles plants which Firestone operated. When these plants were purchased by Firestone in 1955, Mr. Hill was named general production manager, the post he held until being named vice-president.

Goodrich Data System

► B. F. Goodrich Co., Akron, Ohio, has completed an electronic data processing system as part of a national mechanization program to improve communication and control over its domestic sales and manufacturing operations. The company has installed at its headquarters in Akron two solid-state IBM data processing systems, a 7070 and a companion 1401.

John N. Hart, vice-president and controller of Goodrich, states that the company has for many years been interested in computing equipment for the solution of business problems. He explained that the new system will provide Goodrich with the means to tighten control of its widespread operations, to speed communications between manufacturing and sales outlets, and to improve customer service and product quality.

Adhesive Talk Given At Ontario Meeting

► The Ontario Rubber Group held a technical meeting on January 10 at the Cloverleaf Hotel in Toronto, Ontario, Canada with 95 members attending. The technical speaker was William M. DeCrease, whose subject was "Progress in Rubber-to-Metal Bonding from 1955 to 1960."

Mr. DeCrease, supervisor of the Elastomer Section of the Research and Development Department of the Hughson Chemical Co., Erie, Penna., stated that in early 1955, brass plating accounted for about 20 per cent of the rubber-to-metal bonded parts being made in industry. He explained that in the remaining 80 per cent two-coat adhesive systems were used in 60 per cent of the bonded parts and only 20 per cent used a one-coat organic adhesive.

According to the speaker, in 1960 brass plating accounted for 15 per cent, and the remaining 85 per cent of bonded parts were made with organic adhesives—55 per cent using a one-coat adhesive and 30 per cent using a two-coat system. He stressed that the increase in the use of one-coat adhesives is indicative of the dependability of today's rubber-to-metal adhesives.

Mr. DeCrease concluded his talk with a look into the next five years in an attempt to predict important developments in rubber-to-metal bonding. His predictions were: the service requirements for rubber-to-metal adhesives will be elevated, with particular regard to resistance to high temperatures, corrosive environments, and organic liquids; the range of cure temperatures for processing bonded units will very likely be expanded; bonding castable elastomers, room temperature elastomers, and vulcanized elastomers to metal will present new challenges, and brass plating will eventually disappear from the rubber-to-metal bonding scene and be replaced by organic adhesives.

USSR Develops New Resin

► According to reports, the Soviet Union has developed a new synthetic resin based on caprolactum, ammonium thiocyanate, and zinc chloride. Called Ekra, the resin is a transparent, liquid-viscous material and can be used to make polythiocyanate-epoxy rubber, resin, and adhesives.

K. L. Lauer

Named by Harwick

► Harwick Standard Chemical Co., Akron, Ohio, has appointed Karl L. Lauer as its technical sales representative in western Pennsylvania, West Virginia, and southern and northwestern Ohio. Mr. Lauer succeeds C. R. Simpson, who has been transferred to the company's Trenton, N. J., office. Before joining Harwick, Mr. Lauer worked on the production squadron of the Goodyear Tire and Rubber Co. in Akron, and was a sales representative for the Motor Rim Manufacturers Co., Inc., in the Cleveland-Akron area. He is a member of the ACS Division of Rubber Chemistry and the Akron Rubber Group.

Firestone Space Research

► Firestone Tire & Rubber Co., Akron, Ohio, has signed a contract with the U. S. Air Force for continuation of an elastomer research program in 1961. Firestone has been working under a contract with the Air Research and Development Command's Materials Central since 1955. The Air Force is vitally interested in natural or synthetic rubbers that will resist the high temperatures to which components in missiles and aerospace vehicles are subjected. Emphasis will be on preparation and evaluation of new types of elastomers for high temperature applications, and studies of the adhesion qualities of high temperature fiber, aging of rubber under space conditions, and stress relaxation at high temperatures. Project coordinator for the government work is Dr. L. J. Kitchen, Firestone research administrative assistant.

New Urethane Resin Developed by Mobay

► A new resin said to permit mass production of urethane rubber parts by fast, low-cost injection and transfer molding or extrusion has been developed by the Mobay Chemical Co., Pittsburgh, Penna. The resin, called Texin, is supplied in granular form to molders and extruders.

According to the company, the new resin cuts part-forming time for cured urethane rubber products from hours to seconds. Previously, Mobay states, production of urethane rubber items entailed a costly, time-consuming liquid casting method that blocked off huge markets for mass-produced parts such as those used by the automotive and original equipment industries. In addition, market areas have been broadened in other fields by the practicality now of extruding urethane stock for hoses, tubing, profiled channeling, and cable jacketing.

Liquid casting of urethane rubber will continue, Mobay indicates, for large-size items such as industrial truck tires or parts that would require a heavy outlay in mold design costs.

It is reported that the major properties of the Texin resin are its exceptional toughness and resistance to abrasive wear, oil and solvents, plus its unique combination of hardness with elasticity.

Tests indicate that urethane parts fabricated with Texin have an elongation of 500 to 800 per cent with a durometer hardness of 60 to 65 Shore A, and up to 250 per cent elongation at 65 Shore D hardness.

Goodrich Hi-Temp Geon

► B. F. Goodrich Chemical Co., Akron, Ohio, will start producing its new Hi-temp Geon vinyl in commercial quantities early in May at its Louisville, Ky. plant. The plastic material, capable of withstanding temperatures many degrees above conventional vinyls, according to Goodrich, is currently being produced in pilot plant amounts at the firm's Avon Lake Development Center. The company states that the vinyl withstands the effects of boiling water so that it can be made into piping for household hot water plumbing and even for industrial hot acids. According to Goodrich hi-temp Geon can be extruded, molded, formed, or stamped on existing plastic processing equipment.

New Synthetic Rubber Developed by DuPont

► A new ethylene-propylene synthetic rubber, which can be sulfur cured by conventional rubber industry techniques, has been developed by the Elastomers Research Laboratory of E. I. du Pont de Nemours & Co., Wilmington, Del. According to DuPont, laboratory tests indicate that the polymer is well suited for general purpose use, and it appears to have excellent resistance to ozone, weather, and abrasion. The company also found that the new elastomer processes well and can be compounded in a wide range of stable colors.

DuPont is planning field evaluations of the new synthetic rubber to verify the findings of the research laboratory. The company reports that if the laboratory tests are borne out, small quantities of the new polymer will be manufactured at a pilot plant located near Beaumont, Texas. The material will be in short supply and samples will not be available until later in the year, with full-scale commercial production probably two years away, the company added.

RCA Shifts Emphasis

► Rubber Corp. of America, Hicksville, N. Y., has started a major expansion of its Hicksville facilities, switching emphasis from manufacturing to fabrication. When completed, the new facilities will contain the latest equipment for fabricating vinyl resins. The company is also planning to do more marketing of its own fabricated resin in the form of profiles, film and sheeting products, and rigid sheet as opposed to its former role as a specialty resin raw material supplier. The firm is not planning to expand its resin manufacturing facilities. Construction of the new unit is expected to be completed by the last quarter of this year.

New Latex Backing

► General Latex and Chemical Corp., Cambridge, Mass., has developed a new latex backing for fabrics which, according to the firm, has an excellent dye receptivity. The new line of upholstery compounds is said to receive the dye to the extent that the backing achieves the same color as the fabric.

L. H. Perry

J. C. Smith

Named U B S Vice-Presidents

► Dr. Lloyd H. Perry and John C. Smith have been appointed vice-presidents of the U B S Chemical Co., Cambridge, Mass. Dr. Perry will assume the title of vice-president and technical director, and Mr. Smith's title will be vice-president and director of marketing and sales.

Dr. Perry, a graduate of Wesleyan University, served as an instructor at the University of New Hampshire from 1939 to 1940. In 1940, he received his master's degree from New Hampshire. He was a teaching fellow and research associate at the Massachusetts Institute of Technology from 1940 to 1946, when he received his Ph.D. in organic chemistry. He then joined U B S Chemical and was named technical director in 1948.

Mr. Smith is a 1950 graduate of the University of Massachusetts, where he received a B.S. degree in chemistry. Prior to joining U B S Chemical in 1957 as industrial sales manager, Mr. Smith was associated with Pitman-Moore, a pharmaceutical firm. In 1960, he was appointed director of marketing and sales.

Merrill Named Director

► Dr. Robert A. Merrill, formerly director of tire quality control, has been appointed director of product development for the Tire Division of U. S. Rubber Co. He succeeds Dr. Arthur W. Bull, who has retired from active service but will remain available as a consultant. Dr. Merrill gained his Ph.D. degree in physics at the University of Wisconsin. He joined U. S. Rubber in 1935 as a new products development engineer in the Tire Research and Development Department in Detroit, and in 1940 was made assistant manager for new products. In 1945 he became manager of process development and engineering, and in 1955 moved into production as assistant factory manager of the Detroit plant. The following year he moved to the Chicopee Falls, Mass. plant as assistant factory manager. He became assistant production manager of the Tire Division in 1957 and the following year was named assistant director of tire development. He was appointed director of tire quality control in 1960. Dr. Merrill is succeeded in this post by Robert G. Francis, formerly assistant production manager for the Tire Division.

Cochran Retires

► D. C. Cochran, president of Southern Latex Corp., Austell, Ga., retired from active management of the corporation on February 28, 1961. He will continue his association with the firm, which he founded in 1949, as a management consultant. The company reports that George N. Brunt, general manager, will direct operations, and P. C. Chesney will serve as general sales manager.

Seiberling Sued For Conflict of Interest

► A suit alleging conflict of interest was filed on February 20 against the Seiberling Rubber Co. and 13 other defendants by Edward Lamb, a director and largest single shareholder of the company. In his suit, filed in Wilmington, Del., Mr. Lamb charges that Seiberling purchased $400,000 worth of truck tire building machines in 1960 from the National Rubber Machinery Co. at excessive prices without competitive bids.

The suit seeks to sequester the Seiberling stock held by the defendants, including J. Penfield Seiberling, board chairman and president; Lucius Seiberling, vice-president of sales, and Willard Seiberling, a director of the company. The suit also seeks restitution of any funds determined to have been lost to the company by conflict of interest.

Defendants Named

The First National Bank of Akron and Eastman Dillon Union Securities & Co. are the other corporate defendants. The individual defendants are: Edward T. Herndon, partner in Eastman Dillon; Harland E. Paige, a Seiberling director and president of the First National Bank of Akron; Paul A. Frank, a Seiberling director and president of the National Rubber Machinery Co.; and L. N. Buckingham, R. J. Thomas, E. A. Hensel, H. P. Schrank, and R. Tyler Sweeney, all Seiberling directors.

In regards to the machinery purchase, Mr. Lamb charged that the "loss to Seiberling, directly or indirectly, as a result of the transaction, accrued to the personal and individual benefit of Mr. Frank." Mr. Lamb also charged Mr. Paige with using his position "to benefit the First National Bank of Akron and the interests of the three Seiberlings and himself without regard to the best interest of the company and its stockholders."

Cites Bank's Part

The suit states that the bank acts as trustee of a retirement or a pension fund for Seiberling employees, and on instructions from Mr. Paige "the bank has used substantial funds in the retirement or pension fund to purchase common stock from Seiberling in order that these shares could be voted by the bank as trustee in favor of the three Seiberlings." This move, the suit alleged, "worked to the end that the Seiberlings and their nominees may be elected to remain on the board of directors of Seiberling Rubber Co." In addition, the suit asserts that "Mr. Paige has recognized, by declining to vote on certain issues before the Seiberling board, a conflict of interest between his duty to the bank and his duty owed Seiberling."

Mr. Lamb also accused the three Seiberlings and Mr. Herndon of paying $250,000 in underwriting fees to the Eastman Dillon Securities firm without competitive bidding for the services. A further accusation was made against J. P. Seiberling and Willard Seiberling as having served as officers and directors of supplier firms.

Seiberling Takes Action

A Seiberling spokesman stated that the suit is just one more of a long series of attacks by Mr. Lamb which are part of his attempts to seize control of the company. Mr. Lamb's charges will be met in court and properly refuted, the spokesman added.

On February 7, eleven management directors of Seiberling filed documents with the Securities & Exchange Commission that will permit them to answer press criticism from Mr. Lamb, and to defend the company if Mr. Lamb opens a new proxy fight. Mr. Lamb waged an unsuccessful proxy fight for control of the company in 1956.

The 14-B proxy soliciting forms were filed by J. P. Seiberling and 10 other directors elected by management proxies at the firm's last annual meeting. Mr. Lamb's shares elected the other four directors on Seiberling's 15-man board.

According to Mr. J. P. Seiberling, Mr. Lamb has released company information to newspapers and magazines, and the SEC filings were necessary to comply with that agency's regulations in answering Mr. Lamb's criticism and getting correct information to the press.

Nopco Isocyanate Unit

► A new plant for the production of isocyanate for urethane foams is being built at Linden, N. J., by the Nopco Chemical Co. The plant will have an initial capacity of 10 million pounds a year, and is designed to be expandable to 20 million pounds.

W. J. Watson

Named by General Latex

► William J. Watson, general manager of the Ashland, Ohio, plant of General Latex & Chemical Corp., Cambridge, Mass., has been elected a vice-president of the General Latex & Chemical Corporation of Ohio. Mr. Watson joined the firm as a sales representative in 1956 and was named general manager of the Ashland plant in 1958. He will continue his present duties as general manager of the plant.

Plastics Institute Formed

► The European American Plastics Institute has been formed to promote exchanges between the European and the American plastics industry, both technologically and commercially. To promote this aim, the Institute issues a monthly bulletin containing information about new developments in the European plastics industry—European patents, markets, plastics and polymer chemical research. Through the Institute, research projects are conducted at European universities which are available to American plastics companies in the fields of applied research. The foundation is sponsoring round trip flights to Europe which will enable members to visit various plastics exhibitions during 1961.

Japanese Firm Licensed

► Products Research Co., Burbank, Calif., has signed a license agreement with the Yokahoma Rubber Co. in Japan, covering the American company's aircraft and allied electrical products. The agreement extends to Japan, Okinawa, Taiwan and other areas in the Far East.

Clendenen Addresses Washington Group

► D. A. Clendenen gave a talk on "Unconventional Tires" at the January 25 meeting of the Washington Rubber Group, held at the PEPCO Auditorium in Washington, D. C. Mr. Clendenen, manager of manufacturers sales engineering for the Firestone Tire & Rubber Co., informed the group that the tire industry is frequently faced with requirements far beyond the capacity of normal tires. He discussed the requirements for tires having ground pressures less than that of the human foot, and others capable of land speeds approaching 600 miles per hour. He explained the techniques involved in developing these unconventional tires. Mr. Clendenen illustrated his talk with slides and a motion picture on automobile races. The movie utilized the Cinerama technique which enabled the audience to have the illusion of viewing the race from the driver's seat in a racing car.

U.S. Rubber Logging Tire

► A steel-reinforced tire designed for the rugged conditions encountered in hauling logs from forest to mill has been developed by U. S. Rubber Co., New York, N.Y. Tests conducted in the Pacific Northwest logging area over the past four years have indicated a two-thirds reduction in tire failures as compared to conventionally-designed logging tires, according to the company. The new tire, the U. S. Royal Fleetmaster Super Logger S.R.T., features a steel reinforced tread consisting of several thick layers of tread rubber containing many thousands of short lengths of brass-coated, hardened steel filaments, closely interlaced, yet individually rubber-insulated. They form a dense, protective mat between the tread, shoulder and buttress areas of the tire and its nylon cord body.

Enjay Butyl Selector

► Enjay Chemical Co., New York, N. Y., has issued a pocket-size sliding table which selects the type and amount of filler to be used with Enjay Butyl HT 10-66 to secure a rubber with desired, pre-selected physical properties. The sliding selector also indicates the quantity and type of chemicals to be added to the base compound for cure.

The panelists of the symposium on "Radiation and Rubber," held by the Akron Rubber Group on January 27. They are left to right: George I. Doering (Industrial Nucleonics); Thomas C. Gregson (Goodyear); R. F. Anderson (Goodrich), moderator; Dr. John W. Liska (Firestone); and John W. Born (Goodrich).

Akron Holds Radiation Symposium

► A symposium on "Radiation and Rubber" was held by the Akron Rubber Group on January 27 at the Sheraton Hotel in Akron, Ohio. The technical session was attended by 350 members, and some 460 members attended the dinner meeting. The after-dinner speaker, Dr. Tennyson Guyer, director of public relations at the Cooper Tire & Rubber Co., Findlay, Ohio, delivered a talk entitled "Mandate for Tomorrow."

R. F. Anderson (Goodrich) served as moderator of the radiation and rubber symposium. The panelists and their subjects were: Dr. John W. Liska (Firestone), "The ABC's of Radiation"; John W. Born (Goodrich), "Radiation Deterioration of Elastomers"; Thomas C. Gregson (Goodyear), "Radiation Vulcanization"; and George I. Doering (Industrial Nucleonics), "Radiation Techniques for Analysis and Measurement."

In his introductory remarks, Mr. Anderson stated that without doubt the most far reaching contribution of the post-war period must be the development of atomic energy to the point where it has become commercially available. According to the moderator, while we are very much aware of some of the dramatic applications of atomic energy, the future uses to which it may be put are almost beyond comprehension.

Mr. Anderson pointed out that the rubber industry is not unaware of the impact atomic energy may have on its processes and products, and this atomic energy already is being employed in production operations in many plants. Mr. Anderson stressed that this is only a beginning of the applications of atomic energy to rubber, and the industry still has much to learn.

Dr. Liska, the first speaker on the symposium, stated that the development of the atomic bomb and later nuclear reactors as potential sources of power for peaceful uses, have provided us, for the first time, with usable quantities of two kinds of radiation which prior to this time were more or less laboratory curiosities. These are neutrons and gamma rays. A third kind, beta rays, Dr. Liska added, is a form of radiation known and used extensively even before the advent of the atom bomb.

Beta Radiation Described

The speaker, assistant director of research for the Firestone Tire & Rubber Co., proceeded to describe the activities of the three radiation types. Beta radiation, he explained, consists of negatively charged electrons and the useful forms have speeds or energies corresponding to a range of a few thousands to millions of electron volts. He pointed out that these beta rays can penetrate quite a lot of air, but that even the fast ones are, for all practical purposes, nearly completely stopped

or absorbed by fairly thin sections of the substances being irradiated. According to Dr. Liska, their penetrating ability is generally inversely proportional to the density of the substance being irradiated.

In his discussion of gamma rays, Dr. Liska explained that gamma radiation is a by-product of the radioactive disintegration of atoms. In contrast to beta rays, which are corpuscular in nature, gamma rays are a form of electromagnetic energy and have all the characteristics of electromagnetic waves. They interact with atoms, carry no electrical charge, and are quite energetic. Dr. Liska pointed out that gamma rays essentially are high energy X-rays.

Neutron Characteristics

As for the neutron ray, Dr. Liska remarked that it has some of the characteristics of both betas and gammas, plus some not common to either. He explained that neutrons are corpuscular in nature, carry no electrical charge, are capable of penetrating even very dense materials, are dangerous to handle, are available in high intensity only from or near power reactors, and produce radioactive isotopes in the material being irradiated.

Having described the three principal radiation types, Dr. Liska discussed methods of measuring radiation and defined dosage units. He informed the group that there are three broad types of instruments which are used to measure and control radiation. These are ionization gauges, geiger counters, and scintillation crystal counters. According to the panelist, measurement of radiation dosage is based on methods developed by X-ray and radium technologies. The dosage units used, he said, are the curie, the roentgen, the rep (roentgen equivalent physical), and the rad.

Effects of Radiation

The second speaker, Mr. Born, project leader in radiation research for the B. F. Goodrich Co., stated that it is important for rubber scientists and technologists to recognize that nuclear radiation induces both beneficial and detrimental effects in elastomers and rubber compounds. He discussed the detrimental effects of nuclear radiation which concern those who produce rubber products for radiation service. His remarks dealt principally with the results of gamma irradiation in air at room temperature.

Excitation and ionization are the primary basic radiation effects in elastomers, he stated. Numerous secondary effects can follow, such as chain scission, degradation, and unsaturation on the one hand, and cross-linking, end-linking, branching, and gelation on the other. According to Mr. Born, molecular rearrangement, *cis-trans* isomerization, and gas evolution resulting from the removal of substituent hydrogen atoms and chemical groups can also occur. He pointed out that when elastomer or rubber samples are irradiated in air, activation of both polymer and oxygen molecules, plus generation of ozone, accelerate oxidation and ozonization.

Mr. Born stated that although any radiation-induced deterioration in rubber physical properties represents radiation damage, the term usually concerns tensile properties, dynamic mechanical properties, stress relaxation, compression set, hardness, specific gravity, and volume swell. His discussion on these practical effects of radiation damage involved representative rubber compounds. He added that the severe volume restrictions of most laboratory radiation facilities limit general testing to measurements before and after irradiation.

Evaluating Radiation Damage

The Goodrich researcher stated that the second category of tests for evaluating radiation damage involves testing during irradiation. He explained that continuous stress relaxation and compression set are among the most common and serious forms of service failure of rubber, and irradiation accelerates both processes by inducing permanent chain scission and, in the case of compression set, concurrent cross-linking in the deformed sample.

According to Mr. Born, three aspects of rubber compounding critically affect radiation resistance. These are: educated selection of rubber pigments and fillers for maximum radiation stability; careful choice of that state of cure giving the best radiation resistance, and practical design of the rubber compound and component for optimum performance in the precise service application. According to the panelist, at present, compounding for radiation resistance is partly an art, but important progress is being made in systemizing it. He emphasized that the essential basis is a premium quality rubber compound, properly cured for optimum specific service.

The third speaker on the radiation symposium, Mr. Gregson, pointed out that one of the major radiation research efforts of interest for the rubber industry deals with the curing of unvulcanized elastomers. He remarked that such a beneficial use of radiation contrasts sharply with the stigma normally associated with nuclear radiation because of the undesirable damaging effects which it frequently induces.

Radiation Source Research

According to Mr. Gregson, who is head of the Radiation Section of the Research Division at the Goodyear Tire & Rubber Co., research is now being done with expensive radiation sources, such as man-made cobalt-60, so as to be prepared to take advantage of the enormous quantities of cheap fission wastes which should be available in the nuclear power economy of the future. The speaker expressed the feeling that this is a feasible approach in that it is possible to translate results obtained with one form of radiation directly into those to be expected from a different sort because the effects do not depend much upon the specific type of radiation which is used.

Mr. Gregson pointed out that the technologist faces a difficult task when attempting to set down the specific reactions which may occur within a system as complex as rubber. He noted that three things occur qualitatively: the fundamental interaction between radiation and rubber gives rise to a host of reactive species; these excited entities enter into recombination reactions which eventually induce cross-link formation and/or chain scission, and the ensuing rearrangements in molecular structure yield the property changes which are observed after irradiation.

Improvements in Quality

The speaker observed that there are certain improvements in the quality level of vulcanizates which the method would seem to promise, one of which is a better rubber by virtue of carbon-to-carbon bonds. Since non-carbon intermolecular bridges are apt to offer greater susceptibility to oxidative and thermal attack, he explained, radiation cross-linked rubber could be expected to

possess improved resistance to aging, elevated temperatures, and wear and tear resistance.

Mr. Gregson was of the opinion that considerable progress has been made in elucidating the mechanisms of radiation vulcanization and the effects of various physical and chemical parameters on both the rate of curing and the quality of resultant vulcanizates, but much is yet to be done. By and large, he pointed out, radiation vulcanizates prepared from general-purpose rubbers are found to be of a somewhat poorer quality than their conventional counterparts, yet the opposite is frequently observed with special-purpose elastomers.

The final speaker on the radiation panel, Mr. Doering, discussed instruments which are used to detect changes in a radiation field due to radiation passing through rubber. He explained that industrial radiation instruments operate with fields of from approximately 400 milliroentgens per hour to 0.2 mr. per hour at the detector, with the latter figure being 10 times normal background.

Measurement Techniques

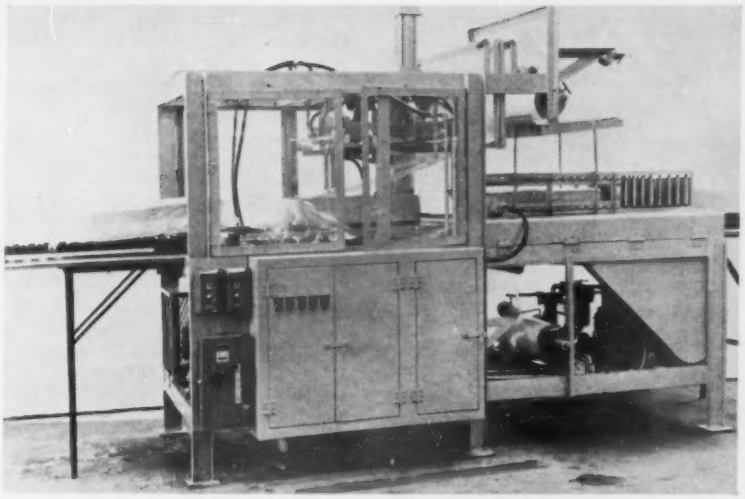
Mr. Doering, manager of the Customer Engineering Department of the Industrial Nucleonics Corp., Columbus, Ohio, explained that many laboratory measurement techniques, such as radioactive carbon dating, utilize much lower quantities of radiation. An examination of the electromagnetic spectrum, he pointed out, may give a better perspective of the use of radiation for measurement. At the low energy end, he remarked, we have radio frequency spectroscopy such as nuclear magnetic resonance. A further energy increase brings one to the infrared region.

According to Mr. Doering, a number of factors must be considered in selecting radiation sources for commercial instruments. First, he stated, is the type of radiation, such as beta, gamma, neutrons, or possibly some combination of the three. Then there is the energy of the radiation emitted by the various isotopes. He explained that the energy desired will be primarily determined by the mass which the energy must penetrate without being completely absorbed. Another consideration, the panelist continued, is the state of the matter. He pointed out that krypton is chosen as a source because it is an inert gas which is inherently safe. The amount of isotope required partly depends on the radiation field strength required at the detector.

The speaker stated that the oldest and most important radiation measurement application in the rubber industry is the use of the beta gauge for measurement and control of calenders coating rubber on tire fabric. This instrument utilizes Strontium 90 emitting beta radiation with energies up to 2 mev, and the half-life is approximately 25 years. According to Mr. Doering, the addition of continuous radiation measurement to the calender train results in a more uniform tire fabric, allowing the average weight to be reduced without producing any material below specifications.

He pointed out that there has been an increasing interest in tire fabric profile during recent years, brought about merely by following the natural trend of continuously improving process control. Mr. Doering stressed that an important consideration of measurement is how representative is the measurement. Continuous measurement, he explained, is always better measurement than a periodic or sampling type of measurement.

There are presently four modes of profile measurement used in conjunction with beta gauges, he re-



The rubber baling machine, developed by Texas-U. S. Chemical Co., is designed for wrapping and heat sealing bales of all types of rubbers in thermoplastic film.

Texas-U.S. Granted Rubber Baling Patent

► Texas-U. S. Chemical Co., Port Neches, Texas, has been granted a United States Patent on its development of a machine designed to wrap and heat seal bales of synthetic rubber in thermoplastic film. The bale wrapper is being manufactured commercially for all types of rubber by J & J Manufacturing Co., Beaumont, Texas, under license from Texas-U. S.

The unit employs a simple, single pass operation which can be easily incorporated in any existing conveying or packaging line, the company states. In operation, bales of rubber transmitted to the machine by roller conveyors are positioned between top and bottom sheets of clear or opaque plastic film, e.g., polyethylene, biaxially oriented polystyrene, or a polyethylene-polyisobutylene blend. A time cycle controller regulates electrically-heated sealing surfaces which rapidly form a thermoplastic, protective envelope having sufficient space on all sides for in-transit plastic movement of the rubber without breakage of the enclosing film.

According to the company, easy identification of the type of polymer in each package is afforded the rubber customer by the ready adaptability to use of printed film strips, preprinted film, or a film printer with the bale wrapper.

The bale wrapper is said to be well suited to handle polymers which are particularly difficult to package, such as butyl and the new polyisoprene and polybutadiene rubbers, which have high flow properties and/or tack.

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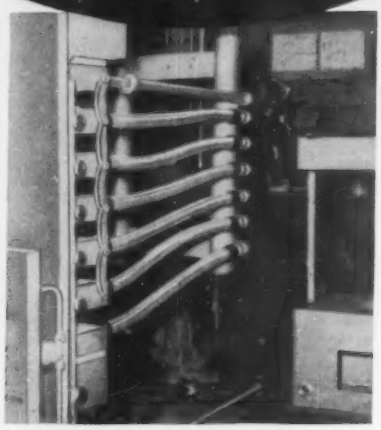

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marked, and the method selected depends upon the process. The panelist explained that in the steel rolling process, a gauge is positioned at only one point, which is the center of the sheet. The cross-sheet thickness cannot vary to any extent or the edges of the sheet will begin to flutter and the material may come completely out of the mill.

Calendering Operations

In the rubber and plastic calendering operations, Mr. Doering pointed out, the standard procedure is to make a measurement on each edge of the sheet. It is intended that these measuring points be established to represent the average sheet weight on each side, assuming that the calender roll shape will maintain the desired sheet profile.

A third method, Mr. Doering said, is called "program positioning." This system moves the measuring head from one point to another periodically, giving information on weight variations at the points selected. A three-point control is common where the calender is equipped with cross-axis or roll bending profile control. Normally, the speaker explained, in this case one gauge remains at its side measuring position, and the second gauge periodically moves from its normal position to the center of the sheet. If the weight at the center of the sheet is not in proper relation to the two sides, then corrective action is taken.

Scanning Method

The fourth method, he informed the group, is that of continuous scanning where the source detector head continuously moves from one side of the sheet to the other, and presents a continuous picture of the sheet profile to the operator. When this type of measurement is made on tire fabric, Mr. Doering explained, a great deal of interesting information is obtained.

He gave an example that in one particular operation, feeding the calender at the center of the rolls gave about twice as much difference in edge-to-center of sheet variation as when the calender was fed at the roll edges. He added that this cross-sheet distribution changes with many processing variables such as sheet width, type of rubber, roll temperatures, running speeds, roll contour, etc.

According to Mr. Doering, another measurement use of radiation which is rapidly growing in importance is the gamma ray composition analyzer. This unit has been successfully applied to butadiene-styrene rubber manufacture, he explained, to control the end point of polymerization. In his description of this radiation control system, Mr. Doering stated that butadiene and styrene monomers are copolymerized over a period of 16 to 40 hours in a cascade vessel system utilizing an emulsion polymerization technique. In addition to the monomers, a large portion of the system is comprised of water with small quantities of modifier, activator, soap, and catalyst.

He pointed out that the amount of water may be changed from recipe to recipe and may vary at different seasons of the year. The polymerization of the monomers, he continued, is carried on through the chain of reactors with a short stop being added after the last reactor, terminating the polymerization reaction.

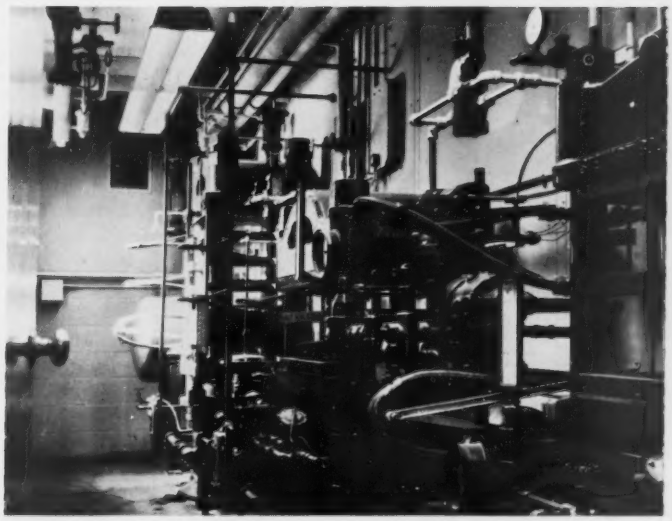
A question and answer period concluded the symposium on "Radiation and Rubber."

C. A. Berridge

G.E. Sales Representative

► Charles A. Berridge has been appointed sales representative of the Silicone Products Department of the General Electric Co., Waterford, New York. His headquarters will be in Downey, Calif. Mr. Berridge graduated from the University of Wisconsin with a B.S. degree in chemistry. He joined the Chemet Training Program of General Electric in 1953, and the following year became a development chemist in the Silicone Products Department. Since 1958, he has been with the rubber market development section. Mr. Berridge is a member of the American Chemical Society.

Unique Curing Room



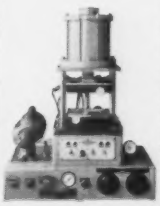
The hot side of the curing room at the new Service Laboratory of United Carbon Co., Inc., in Akron, Ohio. The equipment consists of three compression molding presses (foreground), and a jacketed vulcanizer (background).

The cool side of the partitioned curing room. The controls and regulators for the curing equipment are on the transite partition. Equipment not shown in the photograph includes a two-roll mixing mill and an extruder.

► A transite partition separates the hot from the cool in the curing room at the new Service Laboratory of United Carbon Co., Inc., in Akron, Ohio. Maximum processing versatility is said to be obtained with this unique setup. Equipment in the curing room consists of a two-roll mixing mill, an extruder, three compression molding presses, and a jacketed vulcanizer. The compression molding presses and jacketed vulcanizer are zoned behind the transite partition, and the heat load is taken off by an exhaust system. On the other side of the partition, where the two-roll mixing mill, extruder, and control and regulators for the curing equipment are located, United Carbon laboratory technicians work in an air conditioned atmosphere.

With the new Scott Two-pen Mooney Recorder, you now obtain direct readings from *one* strip chart of (1) viscosity in Mooney Units, and (2) the actual temperature within the test specimen itself. Designed for use with Scott Models NBS and STI Mooney Shearing Disc Viscometers, this new recorder means faster, easier, more accurate rubber testing . . . helps you meet industry standards, insure product quality, and at the same time cut your testing and production costs.

Automatic Controls may be provided for the Two-pen Mooney Recorder for safe, unattended operation. Delay-action timer allows one-minute warm-up — just press the button, the controls do the rest. Another new Scott feature — a strip chart with 10 grads. per inch of time scale for accurate time readings at *any* chart speed. Internal chart illumination and tear-off strips are also provided. The Two-pen Recorder is geared for speeds of ½", 1", 1½", and 2" per minute, with full-scale pen travel in 2 seconds.



Standard Single-pen Recorder is also available for viscosity readings only, with above features and full-scale pen travel in 4½ seconds. For special applications both viscosity and temperature recorders may be adapted for multi-record operation. For complete facts on Mooney Recorders, write Scott Testers, Inc., 85 Blackstone St., Providence, R. I. Tel. DExter 1-5650 (Area Code 401).

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Lack of Materials Closes Cuban Plants

► According to reports, the four expropriated American-owned tire plants in Cuba have shut down due to acute shortages of raw materials, especially carbon black. Three of the plants have been closed since early this year, and the fourth facility, said to have been producing only about 300 tires a week, ceased operation on February 21. Previously the four factories, owned by the Goodyear Tire & Rubber Co., the Firestone Tire & Rubber Co., the U. S. Rubber Co., and the B. F. Goodrich Co., turned out between 10,000 and 20,000 automobile and truck tires a week.

It has been reported that Cuban authorities failed in their efforts to obtain substantial quantities of carbon black from Canada and Europe. Supplies were also sought from behind the Iron Curtain, without success. The report from Cuba indicates that the end of the Cuban tire industry is in sight unless some carbon black and certain other essentials are found quickly.

DuPont Acetylene Plant

► A multi-million dollar facility for the manufacture of acetylene by a new process will be built by E. I. du Pont de Nemours & Co. at the site of its neoprene plant in Montague, Mich. The new unit, which will produce acetylene from low cost hydrocarbon, will be DuPont's first basic facility for the manufacture of acetylene, one of neoprene's chief raw materials. Construction of the new facility will start in late 1961, with completion scheduled for the early part of 1963. According to the company, it has been investigating the low cost routes to the manufacture of acetylene for the past 25 years. The new process, a modified arc technique, is said to offer substantial improvements over other hydrocarbon processes now in use.

Thompson Develops PVC

► Thompson Chemical Co., Pawtucket, R.I., has developed a new low molecular weight polyvinyl chloride resin, called Trulon 630, which is said to offer a high capacity for plasticizer absorption. It also is said to provide a low gel count and a heat stability approaching that of high molecular weight resins.

D. A. Brown

Named by N. J. Zinc

► New Jersey Zinc Co., New York, N. Y., has appointed Donald A. Brown as its sales representative for Tennessee, Alabama, Mississippi and Louisiana. Mr. Brown, a resident of Birmingham, will report to the firm's southern district office in Atlanta, Ga. A graduate of Rutgers University, he served as an officer in the U. S. Air Force during the Korean War.

New U.S. Rubber Group

► U.S. Rubber Co., New York, N.Y. has formed a rocket motor group aimed at increasing its participation in missile development and production. The new rocket group will concentrate on business development in the rocket and missiles field and the execution of government contracts, supplementing the work of the company's operating divisions and government department. Christy H. Madsen, formerly product manager of rubber and chemicals in the Naugatuck Chemical Division, has been appointed coordinator of the rocket motor group. Other members of the group are Paul Blunt, formerly government contact member of Naugatuck Chemical's Commercial Development Department, Raymond A. Herrly, coordinator of New Products and Process in the Footwear and General Products Division, and Dr. Ernest J. Joss, coordinator of military research contracts for the company's Research Center at Wayne, N. J.

► Rayon Processing Co. of Pawtucket, R.I., has changed its name to Microfibres, Inc.

Lexan Discussed at Northeastern Meeting

► The Elastomer and Plastics Group, Northeastern Section, ACS, heard a talk on "The Chemistry and Properties of Some Polycarbonate Resins," by Dr. Kenneth B. Goldblum (General Electric), at its technical meeting on January 17, at the Morse Auditorium in Boston, Mass. The meeting was attended by 75 members and guests. In his address, Dr. Goldblum first gave a brief history of the early work done in the field of polycarbonates. He explained that the time lapse between the early work and the present new interest can be attributed to the unenthusiastic reports made by the early researchers on the properties investigated.

Dr. Goldblum then discussed the development and properties of Lexan polycarbonate resins. He illustrated his remarks with slides, which presented data on the product's impact strength, glass transition temperature, dimensional stability, and electrical properties.

Reclaimers Hold Election

► At its annual meeting on January 25, 1961, in New York City, the Rubber Reclaimers Association, Inc., elected new officers for 1961. Henry L. Dixon (Goodrich) is the new president, Donald L. McCollum (Naugatuck Chemical) is vice-president, and Charles T. Jansen (Rubber Age) was reelected secretary-treasurer. At the same meeting, T. H. Fitzgerald (Naugatuck Chemical) was named chairman of the executive committee, and C. R. Peterson (U.S. Rubber Reclaiming) was renamed chairman of the Education Committee.

Swires in Chilean Post

► Howard Swires has been named managing director of the General Tire & Rubber Co. plant in Santiago, Chile. The Santiago assignment is his fourth foreign appointment. Mr. Swires graduated from the University of Akron in 1939 while working at General Tire. His first foreign assignment was in 1945 as production supervisor at the firm's Mexican plant. His other foreign posts were in Buenos Aires, Argentina, as factory manager, and in Caracas, Venezuela, as assistant to the general manager.

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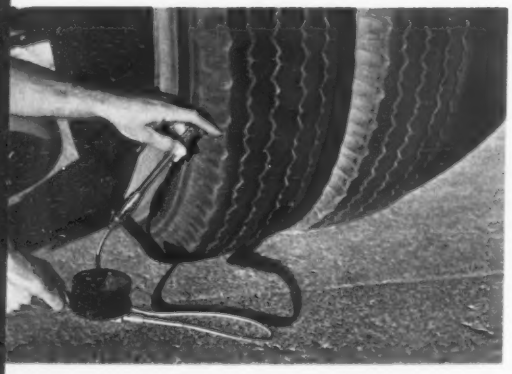

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E. N. Cunningham

Elected by Precision

► Precision Rubber Products Corp., Dayton, Ohio, has announced the election of Edward N. Cunningham as a vice-president of the firm. Formerly sales manager of Precision, Mr. Cunningham's new duties will involve coordination of sales, research and development, and engineering. Mr. Cunningham is chairman of SAE Committee G-4 on Elastic Seals.

Enjay Promotes Two

► S. R. Shuart, formerly technical service coordinator for the Butyl Division of the Enjay Chemical Co., New York, N. Y., has been made responsible for development of the firm's butyl tire program. He is succeeded by W. P. FitzGerald, previously with the Market Development Division of Enjay Chemical. Mr. Shuart joined the company in 1955, serving with the Enjay Laboratories in Linden, N. J., until his transfer to the Butyl Division in 1957. Mr. FitzGerald was with the Chemical Research Division of Esso Research & Engineering Co. before joining Enjay's Market Development Division in 1955.

General Tire Names Two

► General Tire & Rubber Co., Akron, Ohio, has named Homer D. Harrington and Joseph J. Delaplane as assistant managers of its Overseas Division. Mr. Harrington has been with General Tire since 1939. Formerly technical manager in Venezuela, he will be in charge of technical matters in his new post. Mr. Delaplane, who has served as project engineer and factory manager in Holland, will be in charge of production and engineering for the Overseas Division.

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Names in the News

Fred C. Sutro, Jr., formerly polyethylene product manager at Spencer Co., Kansas City, Mo., has been appointed polyolefin marketing manager by Cabot Corp., Boston, Mass.

Henry E. Heilman, vice-president of the International B. F. Goodrich Co., has assumed responsibility for foreign subsidiary manufacturing and sales operations.

A. N. Spanel, chairman of International Latex Corp., has received the Decoration of Grand Officials of the Condor of the Andes, the highest award of the Bolivian Government, for "his unselfish help" to the Bolivian people.

Arnold F. Kaulakis, formerly acting general manager of engineering at Esso Research and Engineering Co., has been elected a vice-president, director, and member of the executive committee of the company.

Alfred N. Watson, formerly vice-president of Alfred Politz Research, Inc., has been elected vice-president of marketing services for U. S. Rubber Co., New York, N. Y.

Carl F. Charles, controller of U. S. Rubber Co., Mishawaka, Ind., has been elected to membership in the Controllers Institute of America.

Laurence Kogos, previously vice-president of the Vinyl Division at Farrington Texol Corp., has been promoted to executive vice-president of the firm.

J. W. Anderson has been appointed manager of the Power Transmission Sales Department of Hewitt-Robins, Inc., Stamford, Conn.

Rolla H. Taylor, sales manager of Scott Testers, Inc., will assume the additional duties of advertising manager for the firm, responsible for advertising, publicity, and public relations.

Lee R. Jackson, vice-chairman and former president of Firestone Tire & Rubber Co., has retired from his active role with the firm, but will continue to serve as a director and executive consultant.

Arthur Kelly, executive vice-president of B. F. Goodrich Co., Akron, Ohio, has been elected to the company's board of directors.

B. T. Ramsay has been appointed sales manager for the new Industrial Products Division of Rubbermaid, Inc., Wooster, Ohio. **Robert F. Brownell** assumes the duties of product planning manager.

William J. Worrell, general sales manager for Bearfoot Airway Corp., a wholly-owned subsidiary of Bearfoot Sole Co., Wadsworth, Ohio, has been elected to the board of directors of the parent company.

Claude A. Pauley has been promoted from comptroller of Firestone Tire & Rubber Co. to the newly-created post of administrative director of insurance, pensions, and salary compensation. He is succeeded by **Lee R. Shannon,** formerly assistant comptroller.

Herman Kahn, chairman of the board of Condenser Service and Engineering Co., Hoboken, N. J., has been added to the board of Lee Rubber and Tire Corp., Conshohocken, Penna.

D. R. Eagleson, formerly assistant sales manager of the Fatty Acid Division of Emery Industries, Inc., Cincinnati, Ohio, has been promoted to the post of sales manager and will be responsible for sales of fatty acids east of the Rockies.

Kenneth B. Hawthorne, formerly director of general promotion for Johnson & Johnson, has been named general product manager of the U.S. Tires Division of the U.S. Rubber Co., New York, N. Y.

Leonard K. Firestone, president of the Los Angeles, Calif., plant of the Firestone Tire & Rubber Co., has been appointed vice-president of the Los Angeles Angels baseball team.

Harold J. Harmon, formerly assistant manager, has been named manager of the Overseas Division of the General Tire & Rubber Co., Akron, Ohio, succeeding **Frederick Comey** who has retired.

S. E. Yeaton

Named by General Cable

► General Cable Corp., New York, N. Y., has appointed S. E. Yeaton as assistant vice-president of the company. Mr. Yeaton previously was associated with John A. Roebling's Sons Corp. as director of sales of electrical wire and cable.

Michel Neumand has been named sales manager for United Carbon France, S. A., subsidiary of United Carbon Co., Inc., and **H. L. Kirchschlager** becomes product manager for sales to South America and Mexico.

Frank A. LePage, formerly chief engineer at the Sao Paulo tire plant of the Firestone Tire & Rubber Co. in Brazil, has been promoted to the newly-created post of senior engineer in charge of all engineering for the company's foreign tire plants.

J. A. Moffitt, Jr., formerly aircraft products sales manager, has been appointed marketing manager of the Connecticut Hard Rubber Co., New Haven, Conn., and **A. J. Francesco,** formerly industrial products sales manager of electrical insulation sales and industrial products, has been named sales manager.

Dr. G. F. Baumann, previously project leader, has been named group leader of the analytical research and polymer characterization group of Mobay Chemical Co., at New Martinsville, West Va.

Walter J. Hood has been appointed regional manager of the Process Equipment Division of the Patterson-Kelley Co., Inc., Clifton, N. J.

Fort Wayne Hears Erwin on Plastics

► "ABS Plastics Properties" was the title of the talk presented at the February 9 meeting of the Fort Wayne Rubber & Plastics Group by K. A. Erwin. There were 160 members in attendance at the meeting, which was held at the Van Orman Hotel in Fort Wayne, Ind.

Mr. Erwin, manager of technical service for the Marbon Chemical Division, Borg-Warner Corp., explained that ABS plastics are polymers of acrylonitrile, butadiene, and styrene. He explained that what makes this a plastic, even though the same materials are used to make elastomers, is a 60 per cent resin content versus the rubber content.

Mr. Erwin pointed out that from its beginning about ten years ago plastics, with such materials as polystyrene, have had an up-hill fight. According to the speaker, it wasn't until 1955 that a true acrylonitrile-butadiene-styrene polymer was manufactured. He cited several grades of Cycolac, produced by Marbon Chemical, as examples of this polymer, and discussed their physical properties and processability.

Neville Names Agent

► Smith Chemical and Color Co., Inc., Brooklyn, N. Y., has been appointed sales representative in metropolitan New York and northern New Jersey for Neville Chemical Co., Pittsburgh, Penna. Neville resins and solvents will continue to be stocked in New York. Neville reports that Donald L. Marsh, with headquarters in Plainfield, N. J., will continue to be available for consultation on any matters of a technical nature concerning its chemicals.

Akron Tire Lectures

► A series of 11 lectures on tire engineering and development began on February 20 at the University of Akron in Akron, Ohio. The series is co-sponsored by the University, Firestone Tire & Rubber Co., General Tire & Rubber Co., B. F. Goodrich Co., Goodyear Tire & Rubber Co., and Seiberling Rubber Co. The lecture program and speakers follow:

February 20, "Introductory Review of Tire Development, Terminology, and Construction" by William Denton (Goodrich).

February 27, "Tire Design, Part One" by W. G. Burket (Goodyear).

March 6, "Tire Design, Part Two" by W. S. McCormick, Jr., (General Tire).

Wharton Jackson

Forms New Firm

► Wharton Jackson Co. has consolidated its western office with that of Harrisons & Crosfield (America) Inc., to form a new firm, Harrisons & Crosfield (Pacific) Inc., with offices in Seattle, Wash., and San Francisco and San Marino (Los Angeles), Calif. The company supplies industrial raw materials, chemicals and clays from domestic and overseas affiliates. Mr. Wharton is vice-president of the new company.

New Manufacturer

► Lauman Golf Supply, Ltd., Kitchener, Ontario, Canada, a manufacturer of golf balls, recently installed a rubber mill and is molding small industrial rubber products. In addition, the firm is now compounding and milling its own balata cover stock as well as the rubber centers used in its golf balls. According to Lauman, the formulating, compounding, and milling of rubber for industrial use will be done, for the present, on a custom molding basis.

March 13, "Tire Design, Part Three" by A. F. Weber (Firestone).

March 20, "Tire Construction Materials" by R. J. Jacob (General Tire).

March 27, "Tire Design Calculations" by O. H. Johnson (Seiberling).

April 3, "Manufacturing Process, Part One" by L. R. Keltner (Goodrich).

April 10, "Manufacturing Process, Part Two" by G. E. DeMarco (Firestone).

April 17, "Field Service" by W. S. Zeigler (Goodyear).

April 24, "Indoor Tire Testing" by A. B. Heiberg (Firestone).

May 1, "Outdoor Tire Testing" by W. C. Johnson (Goodyear).

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Financial News

Goodyear 1960 Sales Are Second Highest

► Goodyear Tire & Rubber Co. reports sales of $1,550,940,519, and earnings of $71,022,877 for 1960, the second highest year in the history of the company. This compares with sales of $1,579,257,984, and earnings of $76,008,956 in 1959, the company's banner year. Earnings per share in 1960 amounted to $2.10, as against $2.24 the previous year. Earnings for 1959, however, included a non-recurring tax credit of $4,500,000, or 13c a share. The company also noted that earnings for the fourth quarter of 1960 rose to $18,123,320, compared with $17,091,114 for the same period in 1959.

Earnings from foreign subsidiaries rose to $25,385,383, despite the expropriation of the company's Cuban plant, which resulted in a net charge of $2,411,145 to the company's reserve for foreign investments. In 1959, income from subsidiaries amounted to $23,116,932. Capital expenditures in 1960 rose sharply to $74,553,746, as against $55,640,633 in 1959. Working capital also was increased to $521,520,071 from $510,392,427 for the previous year.

Rubbermaid

► Three months ended December 31: Net income was $245,840, with earnings per share at 17c, compared with $448,926 and earnings of 31c per share for the same period in 1959. Net sales totaled $6,370,511, as against $6,834,425 for the same 1959 period.

Dayco Corporation

► Year ended October 31: A net loss of $5,968,990 for the year was reported on sales of $99,252,030. In 1959, net income was $2,414,226, or $2.06 per share, on sales of $101,838,313.

Hewitt-Robins

► Year ended December 31: Net profit was $655,929, equal to $1.49 per share, compared with a net loss of $148,504 for 1959. Net sales were slightly lower at $46,038,885, as against $46,612,625 for 1959.

U.S. Rubber Reports Income of $30,737,000

► Net income of the U. S. Rubber Co. for 1960 amounted to $30,737,000, the equivalent of $4.45 a share of common stock. This represents a 13.6 per cent drop from the previous year's figure of $35,580,000 or $5.30 a share. The 1960 figure includes a net loss of $2,105,000, or 37c a share, which the company absorbed in writing off plants seized by the Cuban Government. Net sales in 1960 totaled $966,833,000, compared with $976,766,000 for the previous year.

The company reported a profit of $841,000, or 15c a share, from the sale of an idle plant in Fort Wayne, Ind. Additions and improvements to property, plant, and equipment totaled $26,515,000 in 1960, slightly higher than the $25,003,000 expenditure of 1959. Long term debt was reduced from $159,920,000 to $154,672,000 during the year. Net working capital was increased to $318,281,000, for a working ratio of 3.6 to 1, compared with $312,222,000 and a ratio of 3.2 to 1 at the end of 1959.

Armstrong Rubber

► Quarter ended December 31: Net income dropped to $786,422, or 46c per share, compared with $902,138, or 53c per share, for the comparable period in 1959. Net sales were $23,227,601, as against $23,393,110 in the previous year.

Lee Rubber & Tire Co.

► Year ended October 31: Net income was $322,145, with earnings of 38c per share, compared with $1,521,479 and earnings of $1.78 per share for the previous year. Net sales totaled $44,298,913, as against $52,164,161 in 1959.

Columbian Carbon

► Year ended December 31: Sales rose to a record high of $81,241,000 for 1960, as against $76,838,000 in the previous year. Net income amounted to $6,561,000, or $4.06 per share, compared with $6,908,000, or $4.28 per share, for 1959.

Firestone 1960 Income Highest in History

► Firestone Tire & Rubber Co. reports that its sales and earnings for the fiscal year ended October 31, 1960, were the highest in its history. Net income was $65,029,463, equal to $2.45 a common share, against $64,596,848, or $2.44 a share, for the preceding fiscal year. Net sales rose to $1,207,247,997 from the $1,187,784,024 volume of the last fiscal year. Profits of foreign subsidiaries were $16,894,407, compared with $18,578,206 for the preceding year. Operations of the Cuban subsidiary — which was taken over by the Cuban Government on August 30— have been excluded from the income statement for the period after July 31, and its assets and liabilities were omitted from the consolidated balance sheet as of October 31. A $3,305,564 net charge, after taxes, for the Cuban properties was made against the reserve for foreign investments provided from prior years' income.

General Tire & Rubber

► Year ended December 31: Net sales reached a record high of $753,947,649, as against $676,942,133 the previous year. Net earnings dropped to $22,785,082, equal to $4.07 per share, compared with net earnings of $26,624,080, or $4.84 per share, for 1959.

U.S. Rubber Reclaiming

► Year ended December 31: Sales amounted to $6,957,000 compared with $7,057,227 reported in 1959. Net income was estimated to be in a range of $450,000 to $475,000, or between $1.00 and $1.05 a share, as compared with earnings for 1959 of $657,204, or $1.25 a share.

Raybestos-Manhattan

► Year ended December 31: Net income was reported at $2,911,584, down from $3,904,723 in 1959. Earnings per share fell to $4.61, compared with $6.19 the previous year.

United Carbon

► Year ended December 31: Net income was $5,561,000, the equivalent of $4.24 per share, as against $6,635,000, or $5.21 per share, the year before. Sales were $56,788,000, compared with $62,171,000 in 1959.

New Facilities For Natural Rubber Bureau

► The Natural Rubber Bureau reports that an entire laboratory section within the Natural Rubber Producers' Research Association has been organized to exclusively handle technical service problems. Rubber Technical Developments, previously a joint unit of the Natural Rubber Bureau and the NRPRA (both London) has been made a part of the latter, where it becomes exclusively a technical service and development laboratory available to all users of natural rubber.

The Bureau also announced that in conjunction with the initiation of the exclusive technical service laboratory, another natural rubber technical service representative would be added to its staff in the United States.

Concentrated research effort during 1961 will be applied to developing new blends of natural and synthetic rubbers, and the further oil extension of natural rubber, the Bureau reports. In addition, the organization feels that since natural rubber already can be extended with up to 20 per cent of oil, an additional extension will add to natural rubber's ability to compete in whatever market the future may hold.

New Armstrong Tire Unit

► A new $25,000,000 tire manufacturing facility, now being constructed at Hanford, Calif. by Armstrong Rubber Co., New Haven, Conn., will go on stream early in 1962. The unit will manufacture small passenger tires for compact and sport cars, regular passenger car tires, and highway truck, tractor and excavator tires. The equipment also has been designed to handle all types of fabrics. Initial production is scheduled at 6000 to 7000 tires daily.

Occupying 80 acres on a 320-acre site, the unit will include manufacturing facilities covering 240,000 square feet, a finished goods warehouse of 450,000 square feet, a raw materials warehouse of 210,000 square feet, a 53,000 square foot administration and sales building, parking for 750 automobiles, truck docks where 20 trucks can load tires simultaneously, and a rail spur line for incoming raw materials and shipment of finished tires.

► Seiberling Rubber Co., Akron, Ohio, has added a second premium-level retreading rubber, called Carbo-Preme, to its line of tire repair materials.

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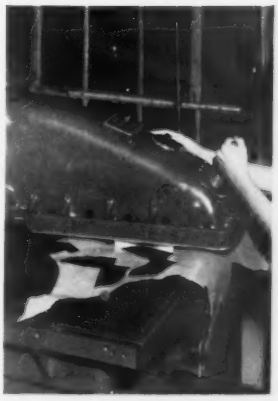

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West Coast News

► The Technical Meeting of the Los Angeles Rubber Group, held on February 7 at the Biltmore Hotel in Los Angeles, Calif., featured an address by Donald C. Jones, research supervisor in the Organic Department, Research and Development Division, Consolidated Coal Co. In his capacity, Mr. Jones works closely in association with the company's chemical subsidiary, Pitt - Consol Chemical Co. The speaker addressed the group on "New Liquid Peptizers."

In his talk, Mr. Jones pointed to the fact that Pitt-Consol employs a novel and efficient solvent extraction process on spent caustic solution to separate phenol, cresols and xylenols from thiophenol, thiocresols and thioxylenols. He noted that the thioxylenols are effective peptizers of both natural and synthetic rubbers. Research studies on these thiols or aromatic mercaptans have resulted in the development of new, odorless peptizers which are more effective than previous types, particularly in synthetic polymers.

The speaker went on to discuss the use of these new peptizers in smoked sheet and in typical oil-extended synthetic rubber polymers and masterbatches. Mr. Jones also outlined the use of the new peptizers in polyisoprene, chlorobutyl and polybutadiene polymers.

The speaker at the dinner meeting, sponsored by the U. S. Rubber Co., was Dr. W. Ballentine Henly, a member of the executive speakers panel of the General Motors Corp. In his talk, entitled "Tomorrow is Coming," Dr. Henly portrayed the startling changes that will be made in our mode of living if technological changes continue at their present rate. Some 300 members and guests of the Los Angeles Rubber Group were in attendance.

► W. J. Voit Rubber Corp., Los Angeles, Calif., has appointed Harry Salter to its technical staff. Mr. Salter formerly was associated with the American Latex Products Corp.

► Mrs. Marie Bell has been named purchasing agent for the Oliver Tire & Rubber Co., Oakland, Calif., replacing L. D. Svendsgaard.

► U. S. Rubber Co. plans to spend $6 million on a five-year program for modernization and expansion of its Los Angeles tire facility. The company expects to double its 1960 expenditures during 1961 to begin its new equipment programs. According to the firm's estimates, motorists in the Los Angeles metropolitan area this year will spend about $109 million for approximately 2,600,000 new passenger tires, 227,000 new truck tires and 2,400,000 retreaded passenger and truck tires. A long-range forecast indicates that by 1965 the replacement tire market in the Los Angeles area will reach approximately $140 million, an increase of about 27 per cent.

► Richard R. Degraf was elected vice-president of American Mineral Spirits Co., Western, at the company's recent board of directors meeting which took place in Los Angeles, Calif. Mr. DeGraf joined Amsco in 1958 as a sales representative and was later appointed manager of the company's office and terminal in Oakland, Calif. He was responsible for the marketing and distribution of Amsco's complete line of technical naphthas, industrial solvents and related chemicals in the San Francisco Bay area.

► Accurate Products Co., Inc., San Diego, Calif., has appointed Jack M. Innis as general sales manager for the firm. The company has also named Hayes Benson Robinson as manager of its Extrusion Department. Mr. Innis was formerly sales representative for the Accurate Rubber and Plastics Co. in San Diego and Culver City. Mr. Robinson has been responsible for experimental development work and production of synthetic and rubber extrusions.

► George P. Goetz has been appointed general manager of the West Coast cushioning products operation of Armour Alliance Industries. Mr. Goetz was formerly manager of production and planning for all Armour adhesives plants. In his new assignment, he will be responsible for the manufacture and sales of Hairflex and Armofoam, produced in the firm's Los Angeles plant.

C. C. Corkadel, Jr.

Named Vice-President

► Claude C. Corkadel, Jr., has been appointed vice-president of the Dural Rubber Co., Flemington, N. J. A graduate of Denver University, where he majored in chemical engineering, Mr. Corkadel had been associated with the Gates Rubber Co. for ten years. In 1954 he joined the Oliver Tire & Rubber Co. in Oakland, Calif., as chief compounder. In 1959 he was transferred to the Dural Rubber Co., a subsidiary of Oliver Tire, and was named a director and plant manager. Mr. Corkadel is a member of the American Chemical Society and the New York and Philadelphia Rubber Groups.

United Carbon Picks Site

► United Carbon Co., Houston, Texas, will construct a new carbon black unit on a 45-acre site north of Los Angeles, near Mojave in Kern County, California. The plant will have an initial capacity of 64 million pounds annually. According to the company, this is sufficient to supply present needs of the area, with room for plant expansion to handle increasing needs in the future. In Los Angeles County alone, the firm points out, more tires are sold than in any one of 44 states in the union. The new unit is scheduled to go on stream by the end of 1961.

► Sierra Talc Co., South Pasadena, Calif., has established its Eastern sales headquarters at 605 Broad St., Newark, N. J. Branch offices and warehouse stocks will also be located in Boston, Mass., Cleveland, Ohio, and Chicago, Ill. Maurice F. Warner has been named manager of the Eastern division.

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Canadian News

► Polymer Corp., Ltd., Sarnia, Ontario, has transferred five of its staff to key positions in the recently-launched French company, Polymer Corp. (SAF), Strasbourg, France. A. R. Powell, formerly production superintendent of the Rubber Department becomes plant manager of the French company; James H. Watt, formerly assistant chief accountant, becomes chief accountant; J. R. Ardagh, formerly economic associate, has been appointed staff assistant to the general manager; R. J. Adams, previously administrative assistant to the manager of the Research and Development Division, has been named administrative assistant to R. E. Hatch, president of Polymer (SAF), and Stanley P. Loos, formerly assistant supervisor of the Copolymer Department of the Canadian firm, has been appointed production superintendent of the new company.

► The 44th Canadian Chemical Conference and Exhibition of the Chemical Institute of Canada will be held August 3 to 5 in the Queen Elizabeth Hotel, Montreal, and will feature more than 60 chemical displays. Exhibitors will be able to display their products for an additional two days, August 7 and 8, during the 18th International Congress of Pure and Applied Chemistry. Exhibits will cover a wide range of products and equipment produced by Canadian, United States and British firms. Chairman of the CIC exhibits committee is D. S. MacKay (DuPont of Canada).

► Building Products, Ltd., Montreal, has purchased the Vinyl and Rubber Flooring Division of Canadian General Tower Co., Ltd., Galt, Ontario. The Galt plant will continue its manufacturing operations for the next few months while the new owner prepares manufacturing facilities in Hamilton, Ontario.

► Polymer Corp., Ltd., Sarnia, Ontario, will construct a new building for its Marketing Division. The building will occupy part of the present Polymer parking lot in Sarnia, and will be completed by October of this year.

► The Rubber Chemistry Division of The Chemical Institute of Canada has announced a schedule for presentation of technical papers on August 4, 1961 at the Queen Elizabeth Hotel, Montreal, during the Annual Conference of the Institute. General papers will be read in the morning and papers on textiles applicable to the rubber industry will be read in the afternoon session. Those interested in presenting a paper should contact C. M. Croakman, Columbian Carbon (Canada) Ltd., 7 Superior Ave., Toronto, Ontario.

► Canadian Industries, Ltd. has set up a technical service laboratory in Toronto which will develop new techniques and uses of rigid foams. Facilities are available for demonstration and application of techniques for foaming-in-place, both by spraying and dispensing.

► Thomas D. Murphy has been appointed Winnipeg technical representative of the Naugatuck Chemical Division of Dominion Rubber Co., Ltd. He will handle sales of all Naugatuck products.

Addresses ACS Group

► New ideas about familiar reactions of natural rubber, useful in the search for new and improved synthetic rubbers, were described by Dr. E. M. Bevilacqua, senior research scientist at the Wayne, N. J., research center of U.S. Rubber Co., on January 10 at a meeting of the Dayton Section of the American Chemical Society in Dayton, Ohio. The speaker, a specialist in the field of rubber deterioration, stated that because of the difficulty of analyzing the high molecular weight rubber directly, chemists are forced to use indirect methods.

He pointed out that an especially useful method is the trapping or isolation of small molecules formed during reactions of rubber, and from this learning about reactions of the rubber itself. According to Dr. Bevilacqua, information from the fundamental study of natural rubber is helping in the evaluation and use of the many new synthetic rubbers, particularly in problems of vulcanization, adhesion and deterioration.

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MARVINOL VR-31	100 parts
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Butyl benzyl phthalate	30
Stabilizer	3
CELOGEN-AZ	5
Stearic acid	0.5

Ingredients are preblended, Banbury-mixed and calendered using conventional equipment and techniques, excepting that stock temperatures are kept below 300° F. Expansion is accomplished by passing the sheet or laminate through an oven set at or above the blowing temperature of the compound, about 380° F.

For spread coating the following starting-point recipe is suggested:

MARVINOL VR-50 or VR-53	100 parts
Dioctyl phthalate	70
Butyl benzyl phthalate	30
Stabilizer	3
CELOGEN-AZ	4

Ingredients may be paint-milled or simply stirred in. Casting and lamination or direct coating can be done with conventional equipment. Fusion, lamination and expansion are accomplished simultaneously at 380-400° F.

The foregoing recipes and conditions are shown merely to illustrate the relative ease with which CELOGEN-AZ can be used to impart the advantages of cellular structure to coated fabrics and other vinyl laminates. Many variations and adaptations are possible.

For more detailed information or discussion of a particular problem, call upon your Naugatuck Technical Representative.

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Division of United States Rubber Company

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SILICONE NEWS from Dow Corning

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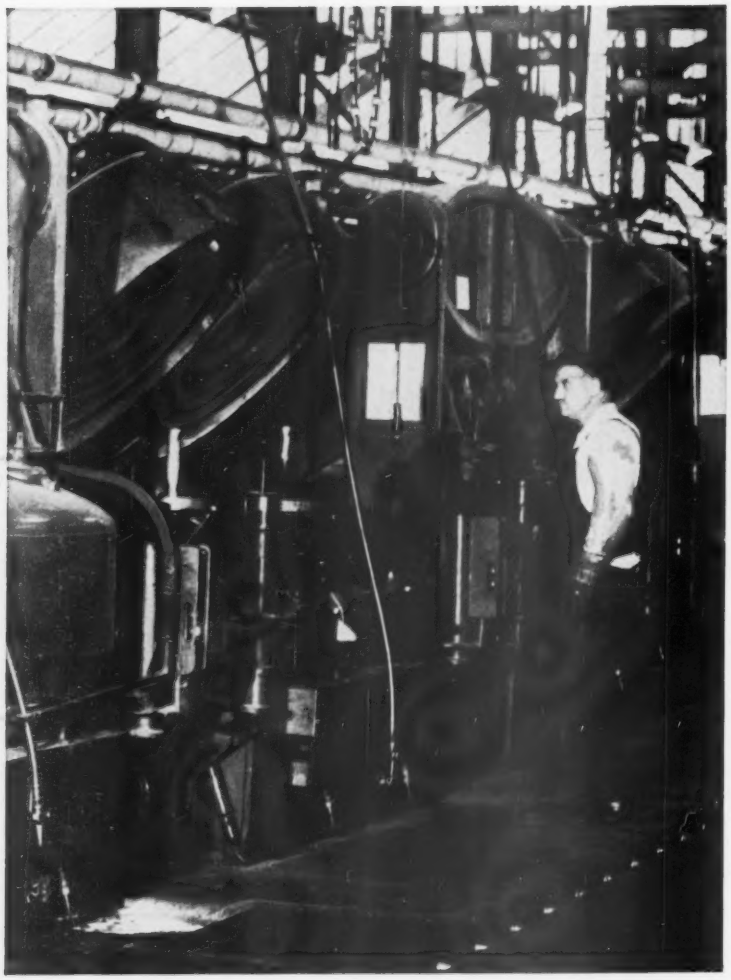

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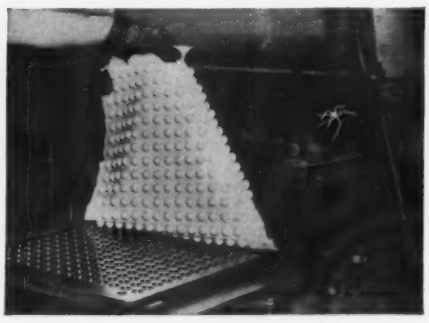
In short, Dow Corning silicone mold lubricants help you mold superior products—help you maintain economical high speed production.



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Overseas

West Germany—Farbenfabriken Bayer, A.-G., Leverkusen, West Germany, is expanding its facilities for the manufacture of high quality synthetic rubber. The company reports that this enlargement of manufacturing capacity, in conjunction with the introduction of new products, is intended to meet the continuously increasing demand of the rubber processing industry. According to Bayer the production capacity for its Perbunan C synthetic rubber is being increased to 25,000 tons a year. The company is planning a project for the manufacture of polybutadiene and polyisoprene synthetic rubbers on a large industrial scale with the aid of recently developed catalyst systems. In addition, the production of a new type of synthetic rubber, Urepan E, is presently underway, and types of rubber with a completely new foundation—ethylene vinyl actetate polymers—are to be manufactured during 1961, beginning on a pilot plant scale.

Norway—Norsk Hydro, a leading Norwegian chemical manufacturer, has announced that its polyvinyl chloride factory at Heroya, East Norway, will increase its annual output from 8,000 to 20,000 tons. This will be achieved through expansion of the company's carbide and chloride plants, which supply the PVC factory with raw materials. Annual output capacity for carbides will be increased from 30,000 tons to nearly 60,000 tons with the installation of a new furnace. This increased capacity is scheduled to go into effect by the middle of 1962.

Amsterdam—A merger of the Royal Netherlands Salt Works, Ltd., Hengelo, and the Royal Sulphuric Acid Works (formerly Ketjen, Ltd.), Amsterdam, is being discussed, according to an announcement by officials of both firms. The formation of a joint holding company, which would exchange its shares for those issued by the two companies, is contemplated.

New Delhi—National Rubber Manufacturers Ltd., Calcutta, India, is sponsoring a new $4.2 million company, General Tyres Ltd., for the manufacture of automobile tires and tubes in collaboration with Technoexport, Prague, Czechoslovakia.

Bangkok—The Government of Thailand has approved a bill to place a small tax on rubber exports to provide a fund to assist replanting.

Mexico City—Otto Moritz, director general of sales for Goodrich Euzkadi, reports that the Mexican rubber industry produced 1.2 million tires last year.

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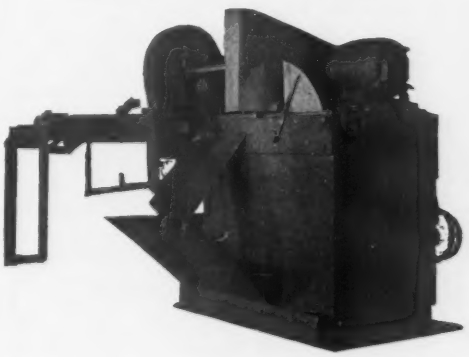

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Obituaries

Parke P. Crisp

► Parke P. Crisp, retired president of the Firestone Industrial Products Co., died on January 27 in Akron after an illness of a year and a half. He was 67 years old. Mr. Crisp received his education in Akron, his native city. He was a star fullback, and was captain of the first Central High football team and captain of the University of Akron's first football team in 1914. He became known to sports followers as "Tumble," playing as a professional on the Akron Indians. In 1916, Mr. Crisp was a graduate of the University of Akron, one of the three first graduates in rubber chemistry. He worked for the Miller Rubber Co. and played professional football before joining Firestone in 1929. He left two years later to become a partner in the RCA Rubber Co., but returned in 1934 as assistant general manager of Firestone's Industrial Products Division. He became general manager in 1939 and president in 1944, when the division became a Firestone subsidiary. He retired in June, 1958. Mr. Crisp leaves his wife and a son.

William F. Bloor

► William F. Bloor, retired executive of the Goodyear Tire & Rubber Co., Akron, Ohio, died on January 29 in Akron, of a heart attack. He was 64 years old. A native of Columbus, Mr. Bloor received his education at Ohio State University. He served on the Ohio State faculty for one year before joining Goodrich in 1919 as manager of commercial sales research. By 1937 he had become the firm's chief statistician. He joined the Goodyear business research staff in 1955, and held this position until his retirement. Mr. Bloor's survivors are his wife and two daughters.

Ferdinand Savarese

► Ferdinand B. Savarese, chemist and director of laboratories for the Advance Solvents and Chemical Division of Carlisle Chemical Works, Inc., died of a heart attack on January 3. He was 44 years old. Mr. Savarese was a graduate of Manhattan College. He is survived by his wife and daughter.

Donald M. Simmons

► Donald MacLaren Simmons, formerly a vice-president of the General Cable Corp., died on January 27 at the age of 71. Mr. Simmons was a graduate of Princeton University, of the class of 1911, and earned an electrical engineering degree there in 1913 and an honorary Doctorate of Engineering in 1939. He was associated with General Cable until 1949, when he left to become a consultant on transmission and distribution to the Economic Cooperation Administration in Paris. Three years later he joined the Mutual Security Agency mission to Italy as director of its office of industrial production in Rome, and in 1953 he became chief of the Agency's electrical power branch in Athens. Mr. Simmons was a former president of the Insulated Power Cable Engineers Association and a member of the American Institute of Electrical Engineers. He leaves his wife, a son, and a daughter.

George L. Allison, Sr.

► George L. Allison, Sr., retired manager of technical information for the B. F. Goodrich Co., Akron, Ohio, died on October 26, 1960, in Akron, at the age of 70. Mr. Allison joined the company's general chemical laboratories in 1917, shortly after graduating from Penn State University. After serving as technical superintendent of processing from 1929 to 1943, he was loaned to the Office of the Rubber Director in Washington, D. C. He returned to Goodrich in 1946 but was loaned out for another government assignment in 1951. He later returned to the company and remained in his post until his retirement in 1955. Mr. Allison was a member of the ACS Rubber Division and the Akron Rubber Group.

Roy Stoughton

► Roy Stoughton, an engineer for Vanderbilt Laboratories, died January 8 in Norwalk, Conn. He was 51 years old. Mr. Stoughton was a member of the Connecticut Rubber Group of the American Chemical Society. He is survived by his wife, four sons, and a daughter.

Gilbert L. Matthias

► Gilbert L. Matthias, retired general superintendent of the B. F. Goodrich Industrial Products Co., Akron, Ohio, died on February 9 at his home in San Juan Capistrano, Calif. He was 74 years old. A native of Galion, Ohio, Mr. Matthias received special training in mechanical engineering after his graduation from high school. He left his first position with the National Tube Co. in Lorain to become a machine designer for Goodrich. In 1914, the late John Gammeter, well-known engineer in the tire industry, requested that Mr. Matthias be transferred to his own experimental department. Mr. Matthias worked on many processes and development projects in close cooperation with Mr. Gammeter. In 1925, he was appointed general superintendent, a position he held until his retirement in 1944. He leaves a wife and son.

Raymond J. McCrory

► Raymond J. McCrory, formerly chief chemist of the National Electric Division of H. K. Porter Co., Inc., died on December 10, 1960, in a hospital in Rochester, Penna., following an extended illness. He was 64 years old. Mr. McCrory was born in Pittsburgh and was a graduate from St. Vincent's College, Latrobe, Penna., in 1918. The following year he became a laboratory technician with National Metal Molding Co., later to become National Electric Products Corp., and in 1921 was promoted to chief chemist. He held this position until his retirement in 1956. Mr. McCrory was a member of the American Chemical Society and represented his firm in ASTM, NEMA, IPCEA and other industry groups. Mr. McCrory's survivors are his wife, two daughters, and a son.

Tom Bradley

► Tom Bradley, president and board chairman of the Sheller Manufacturing Corp., Portland, Ind., died January 3 in Glendora, Calif., where he was vacationing. He was 66 years old. Mr. Bradley began his business career as a clerk for the Paige Motor Co., of which he became a vice-president in 1921. He was a director of Paige from 1924 to 1932. He next joined the Hupp Motor Car Co. where he was president and a director until 1940, when he became vice-president of Sheller.

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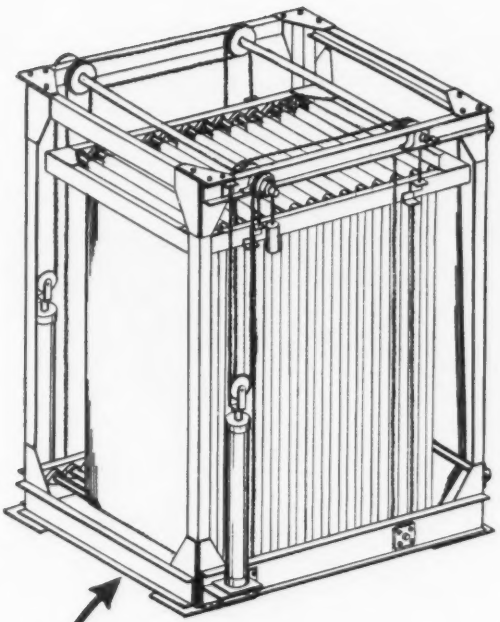

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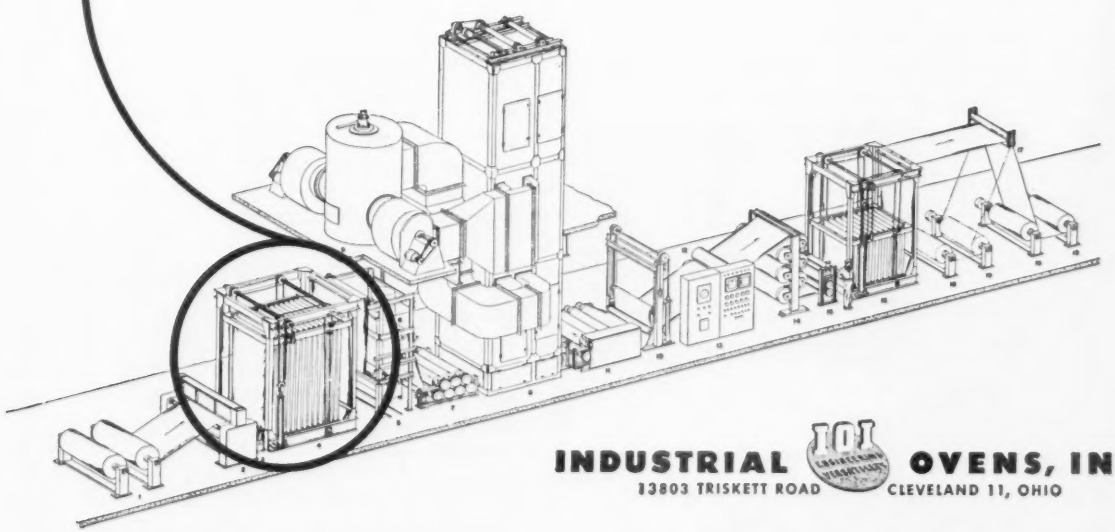

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New Goods

Rubbermaid Bath Mat

► A new bathtub mat, with hundreds of tiny suction cups on its undersurface, has been introduced by Rubbermaid, Inc., Wooster, Ohio. Called Safti-Grip Bathtub Mat, it has a textured top surface which is said to afford secure standing and comfortable sitting. The manufacturer reports that the undersurface suction cups help to

prevent slipping even in the most lustrous bathtubs. The Safti-Grip is available in three sizes ranging from 14 by 25¾ inches to 18 by 30 inches. Nearly 1,000 suction cups hold the large mat in place. Colors include white, yellow, light green, pink, turquoise, and sandalwood. Rubbermaid also manufactures a companion item, the Safti-Grip Shower Stall Mat, said to have the identical advantages of the bathtub mat. The shower mat measures 22¼ inches square and has more than 800 suction cups on its undersurface. It is available in the same colors as the bathtub mat, with the addition of black.

Aldan Hospital Sheeting

► Aldan Rubber Co., Tioga and Salmon Sts., Philadelphia 34, Penna., has added a new neoprene-coated Dacron sheeting to its line of standard and conductive hospital sheeting. According to tests conducted by the manufacturer, the new sheeting is said to be highly resistant to chemical agents such as oils, acids, alkalies, and body excretions, as well as to fire and abrasion. The company reports that the sheeting is also lightweight, flexible, tear resistant, and has a high hydrostatic resistance as well as breaking strength.

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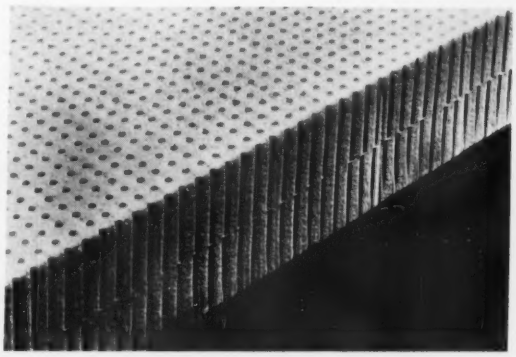
Dutch Foam Rubber Sheeting

► Perforated foam rubber sheets for use in furniture upholstery and the construction of mattresses is being manufactured by N.V. Rubatex of Weesp, Netherlands. A design feature of this sheeting is



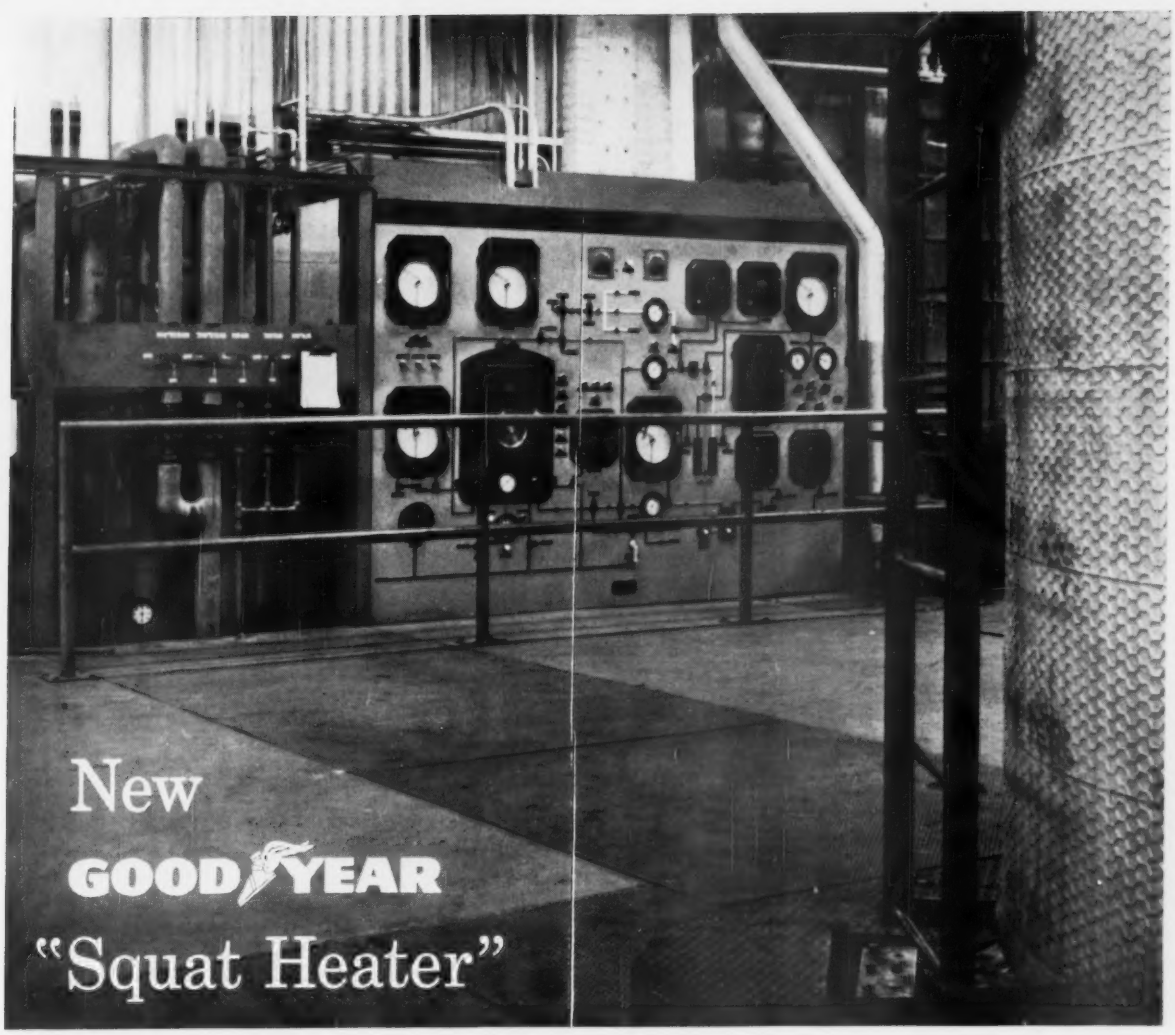
the multiplicity of small holes piercing the material, which is said to reduce the weight by some 20 per cent. In addition, the foam rubber retains all the strength and resiliency of solid foam rubber sheeting. According to the manufacturer, the regularly-spaced holes provide a rough surface which prevents covering material from shifting. The sheeting is available in thicknesses of 0.24 to 4 inches, with widths up to 6½ inches, and it can be cut to any shape without having to finish-seal the borders.

Heavy-Duty Air Hose

► A new heavy-duty air hose for quarries, mines, and heavy construction applications has been developed by the Dayton Industrial Products Co., Melrose Park, Ill., and is being manufactured by Metal Hose and Tubing Co., Dover, N. J. The hose is said to be capable of maintaining working pressures higher than any previous Dayton hose. Marketed under the name Maximair, the hose features double braided high tensile rayon construction. An abrasion-resistant neoprene cover provides maximum protection and assures long wearing qualities even under rugged conditions, the company states. Maximair can maintain pressures up to 400 psi in certain sizes, and is available in 25, 50, and up to 75 foot lengths through 2 inch sizes.

Olympic Butyl Rubber Gloves

► Olympic Glove Co., Inc., 95 Madison Avenue, New York 16, N. Y. is marketing a line of gloves made of butyl rubber. According to the company, these butyl rubber gloves are ideally suited for handling missile fuels and highly-corrosive compounds. The gloves come in small, medium, and large sizes.



fully automated by *Taylor*

Designed for vulcanizing outsize tires for Aircraft and Earth Moving Equipment, the new Adamson United "squat heater" at The Goodyear Tire & Rubber Company's Akron plant is under completely automatic control.

The operator simply pushes a button to start the cycle. A series of green lights indicate completion of the different phases of the process.

Heart of this control system is a Taylor FLEX-O-TIMER* Time Cycle Controller (surrounded on panel above by graphic representation of the squat heater). This instrument precisely times the entire cure. Cure temperatures, both dome and mold interior, are regulated by Taylor FULSCOPE* Recording Controllers. This fully automatic system gives Goodyear:

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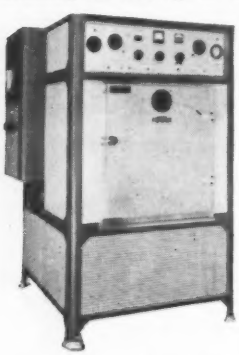
Weather-Ometer® and Fade-Ometer®

A high pressure Xenon Arc with a spectral radiation distribution very close to that of sunlight is now available in the Weather-Ometer and Fade-Ometer.

This new Xenon light source is a 6000 watt water cooled lamp which at a sample distance of 18⅞ inches produces a rate of deterioration equal to that of noon June sunlight.

Both machines have automatic control of black panel temperature, cycles, etc. and are available with automatic control of humidity.

The Xenon lamp is available with constant wattage transformers to insure a uniform radiation intensity regardless of variation in line voltage and controls are provided for increasing the wattage to compensate for loss of intensity due to lamp aging. Anticipated useful lamp life is 2000 hours. Lamp burner tube is easily replaceable by the operator.



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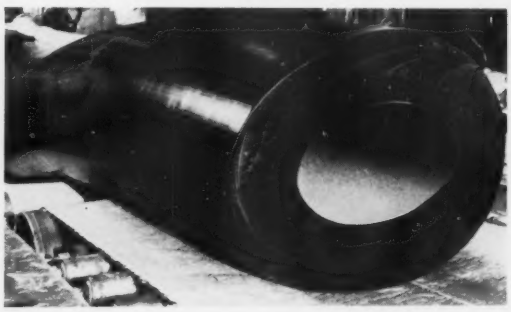
Goodyear Dock Fenders

► Goodyear Tire & Rubber Co., Akron, Ohio, has developed giant 24-inch tubes of synthetic rubber for use as marine dock fenders. Said to be the largest of their type in the world, the



fenders weigh 175 pounds per lineal foot and will absorb up to 52,000 foot-pounds of kinetic energy per foot of length, transmitting relatively small amounts of thrust to the dock. The custom-extruded rubber cushions are produced in 8 and 12 foot lengths and, according to the manufacturer, will take a thrust of well over 300,000 pounds per lineal foot at full compression without damage to the fender.

Ace Vinyl Matting

► A new vinyl matting, said to be extremely resistant to abrasion, is being marketed by Ace Rubber Products, Inc., 100 Beech St., Akron 8, Ohio. Designated as Ace Vinyl Matting, it is made of high-quality vinyl to withstand the deteriorating effects of acids, oils, alkalis, strong soaps, detergents, saltwater, and sunlight. According to the manufacturer, the vinyl matting can be used for many applications on floors of homes, offices, apartments, laboratories, stores, shops, locker rooms, pools, docks, boats, and other surfaces subject to various types of severe wear. The matting is non-porous, with a smooth finish that is easily swept, or wiped clean with a damp cloth. With corrugated wide-rib design, the matting is available in colors of black, brown, gray, and white.

Pioneer Bunny Balloon

► The Funny Bunny is the newest addition to the line of Qualatex balloons manufactured by the Pioneer Rubber Co., 496 Tiffin Road, Willard, Ohio. An all-in-one cardboard backing, covered in clear polyethylene, holds the imprinted toss-up balloon and serves as a colorful hang-up display. The imprinted feet for the bunny balloon are pre-cut for easy removal from the cardboard. When inflated, the Funny Bunny balloon stands three feet high.

PRESSURE PYTHON—Time, always an important factor in the construction industry, figured importantly in the building of a new Princeton, New Jersey housing development. The contractors had to drain a culvert and then build a bridge over it to complete one of the development roadways. Because there was a time limitation involved, it was evident that a pumping process, to clean out the culvert, would have to go on 24 hours a day in order to meet the deadline. The Cordflex suction hose was selected for the round-the-clock task of pumping out the slime and water to clear the way for building the new bridge. This hose was chosen because of its unusual ability to resist pressure, to stand abrasion, and because of its power and stamina for remaining on the job under difficult conditions. The Cordflex hose was made by Acme-Hamilton Mfg. Corp. of Trenton, New Jersey. One of the important materials used in the making of this hose is Mount Vernon duck.

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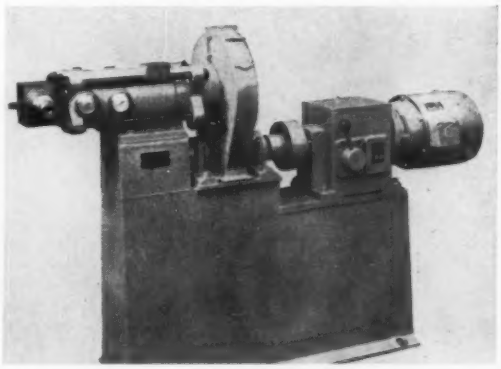

hollow drilled for cooling and carried on precision ball bearings. The screw ratio is 8 to 1. The head and cylinder are provided with steam heating and water cooling inlets and outlets. The screw has a rotary joint installed. The extruder is equipped with two thermometers, and fittings for soapstone are installed in the head. The drive for the 2½ inch unit is directly operated by a three speed gear reduction unit providing screw speed of 28.8, 41, and 60 rpm. The 4 inch unit has the same drive but with screw speeds of 24, 41, and 62 rpm. The entire unit is mounted on a common base. The extruders are supplied ready to run and the electrical equipment is ready to connect to plant power sources.

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► According to Op-Al Electric & Mfg. Co., 3133 Martindale Ave., Indianapolis 5, Ind., its Type R, RG, and FT roller or stitcher heaters are primarily designed for specific operations in the production of rubber and plastic products where a moderate tool heat is required to seal ends of material in process. The R and RG heaters are thermostatically controlled and are normally furnished set at 300°F. pot temperature. The FT heater has an adjustable thermostat control to 700°F. Types R and RG are designed for mounting on an assembly board, while Type FT is a portable heater modified for bench operation. All units are 5 by 7 by 6 inches high and weigh 3 pounds.

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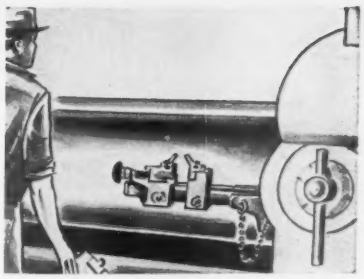

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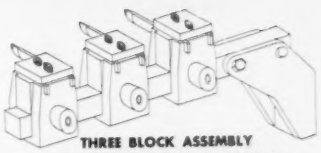

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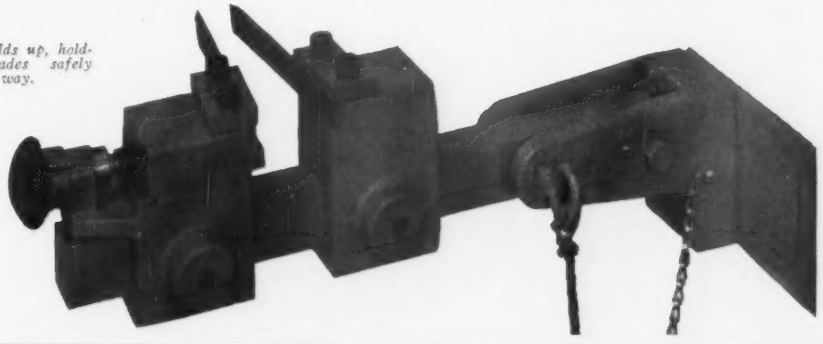

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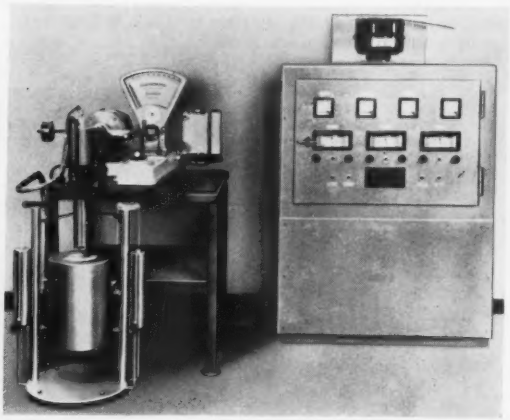
Brabender Plasticimeter

► A high temperature recording plasticimeter, called the C.W.B. Plasticorder, has been developed by C. W. Brabender Instruments, Inc., South Hackensack, N. J. The instrument, which incorporates the C.W.B. Plastograph and a measuring



head of new design with a vertical mixing chamber and shaft, is said to accurately forecast and record plastic properties of materials to 1150°F. The sample measuring head operates within a tube furnace. Temperature uniformity is guaranteed by the manufacturer so that the plasticity of all materials can be measured at either constant or programmed temperatures from 575° to 1150°F. According to the company, the Plasticorder accurately forecasts processability of polymers as well as other materials.

Rubber Thickness Gauge

► A new and accurate rubber thickness gauge system has been developed by Industrial Components, Inc., 416 N.W. Canyon Road, Beaverton, Oregon. According to the manufacturer, the gauge provides, in one installation, both a measurement of the tread thickness across the width of the extended tread rubber and also a second movable gauge roll which may be positioned laterally anywhere on the tread for measurement of taper or steps in the cross section. Multiple gauges can be selected for readout on a single meter. The thickness, in either case, is displayed on a 7-inch meter calibrated in 1/64 inches. The nominal range is zero to 2 inches. Accuracy is said to be better than ±½ per cent of full scale. The display meter is separate from the gauge itself and can be mounted in any location. Some of the design features of the gauge are: built-in voltage regulator, linear scale, solid state components, and overtravel protection resulting in long term stability.

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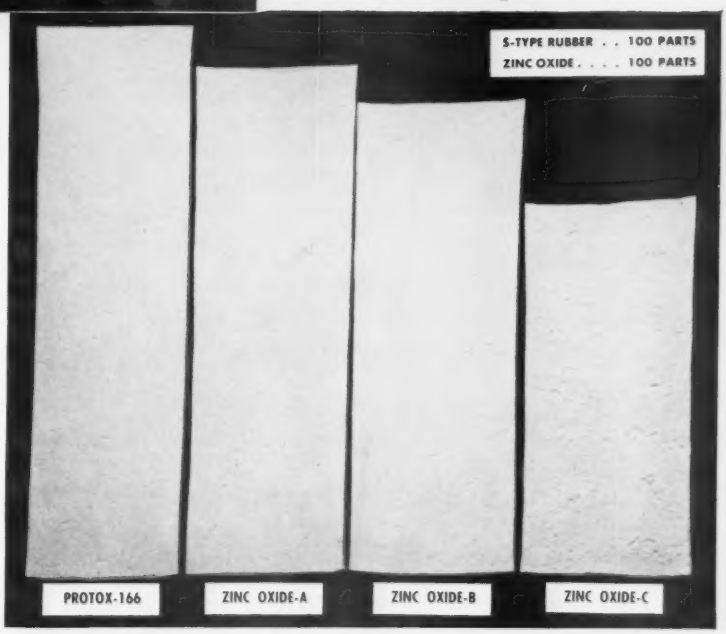

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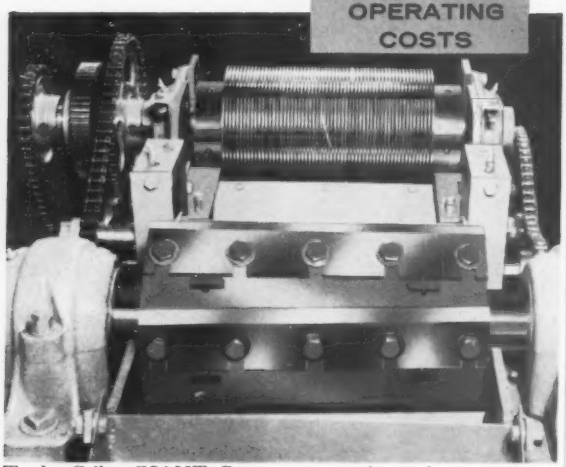

Taylor-Stiles GIANT Cutters are engineered to save you money all ways. They are built around the most efficient cutting method known, where the cutting is concentrated at one point at a time. This saves considerable power, thus requiring smaller machines and motors and gives longer knife life with less down time. Simple bevel edge knives can be sharpened in your own shop. Rugged construction gives long service life. You get a much more uniform end product, effecting further savings in container size and product handling.

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One of the services which we gladly perform for anyone interested in our machines is to cut some of their raw material so that they can see exactly what they will get, before they buy a machine. If you desire this service, just send us a small sample of your product along with information as to size of pellet desired.

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Heavy Duty Metering Pumps

► A new line of metering pumps, the Series 200, has been developed by Wallace & Tiernan, Inc., 25 Main St., Belleville 9, N. J. The pump is electrically driven and is of the positive displacement, reciprocating, plunger type. It has a wide range of capacities, from 0.65 to 2025 gallons per hour. With a metering accuracy within ±1 per cent, the standard model operates against pressures up to 4000 psi. All parts that may come in contact with corrosive solutions are made of corrosion-resistant materials. According to the manufacturer, the pump drive was designed to function with one, two, or three liquid ends, giving increased capacity. In addition, a number of Simplex, Duplex, or Triplex units may be coupled to the same drive shaft for blending two or more liquids. One model of the Series 200 pump may be adjusted for stroke length and feed rate while the pump is running. Another, the "stop-adjust" model, must be stopped during adjustment.

Infrared Spectrophotometer

► A double beam, automatic-recording infrared spectrophotometer, said to be able to identify the structure and reactions of monomers, polymers, and synthetic polydienes, is being manufactured by the Perkin-Elmer Corp., Norwalk, Conn. Called the Model 221 Infrared Spectrophotometer, its features are an automatic gain control system and a programmed scanning speed system. According to the manufacturer, it is used to study rubber oxidation and rubber derivatives; to control sulfur vulcanization; to follow reactions of sulfur with model compounds; and to study crystallinity and chain configuration. Other uses of the infrared spectrophotometer are for identifying types of polyisoprene and following the chlorination and hydrochlorination of rubber. The instrument size is 39 by 16 by 22 inches high.

Rotary Knife Cutter

► A heavy-duty, high-speed, extreme precision knife cutter, said to be capable of handling film sheets up to 48 inches wide, is being manufactured by Sprout, Waldron & Co., 130 Logan St., Muncy, Penna. Primarily for the granulating of roll fed scrap or sheets as thin as one thousandth of an inch, the machine has been designed to provide extremely accurate knife clearances, the manufacturer states, and clearances can be held to within three thousandths of an inch. The rotor cutting circle is 20 inches in diameter. The rotating knives are "shear cut", inserted in the rotor, and firmly wedge-locked in position. An integral knife grinder is furnished which permits the rotor knives to be sharpened without removal from the machine.

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HALLCO NEWS

Issued by
The C. P. Hall Co.
Chemical Manufacturers

No. 14

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When used in the processing of rubber, Hallco C-566 greatly reduces mixing time by speeding up dispersion of carbon black or other fillers. It also gives excellent scorch protection, often more than doubling scorch resistance time. Hallco C-566 has no measurable effect on the hardness of finished products. This economical plasticizer minimizes shrinkage in calendered stock and imparts superior smoothness to extrusions. It gives outstanding results when used for camelback, molded goods, channel stocks, cement stocks and all extruded items. Charts below show its unusual properties in our tests. Hallco C-566 is manufactured by The C. P. Hall Company and is available in drums or tank cars.

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Stock Containing C-566:

	Without C-566 A	With C-566 B
Smoked Sheet	100	
Zinc Oxide	4	
Stearic Acid	0.5	
EPC Black	25	
FEF BLACK	25	
Ultex	0.75	
Sulphur	2.75	
C-566	....	7.5
	158	165.5

Mooney Scorch SR @ 250° F.

Minutes to 3-point rise	5.25	8.0
Minutes to 5-point rise	5.75	8.5
Minutes to 10-point rise	6.25	11.0

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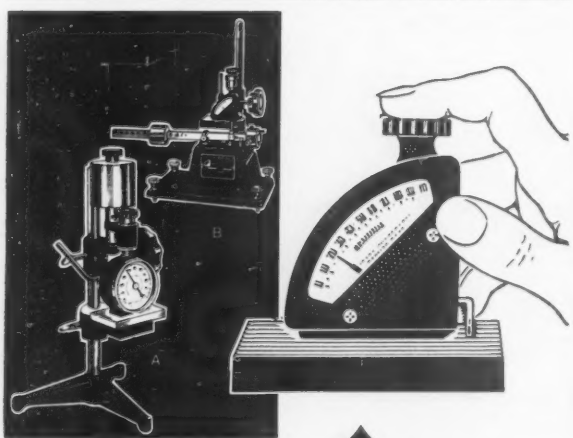

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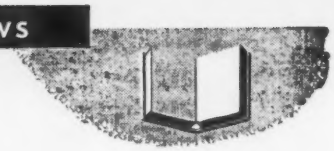
Reviews



Methoden zur Chemischen Analyse von Gummiimischungen. (Procedures for Chemical Analysis of Rubber Compounds.) (Second Revised Edition.) By H. E. Frey and K. E. Kress. Published by Springer Verlag, Heidelberger Platz 3, Berlin-Wilmersdorf, Germany. 5½ x 8¼ in. 170 pp. DM 19.80 (approximately $4.75).

This little handbook is divided into two parts, the first of which deals with conventional analytical procedures of rubber compounds and the second with absorption spectroscopy as applied to rubber chemistry. Methods for determination of mineral fillers, carbon black and sulfur are presented in 58 pages. The analysis for organic components of rubber compounds, comprising identification of rubber hydrocarbon type (the Burchfield method and the method of Parker), the quantitative determination of rubber hydrocarbons in the vulcanizate, the procedure and analysis of acetone extract, acetone-chloroform extract, chloroform extract, and alcoholic potassium hydroxide extract, determination of unsaponifiable components (mineral oil), nitrogen determination (A.S.T.M. procedure), and identification of accelerators and antioxidants (including paper chromatographic procedures), is covered on 62 pages. Miscellaneous methods, which include qualitative and quantitative determination of copper and manganese, and of selenium and tellurium, are discussed in 13 pages.

The second part of the book, in English, by the late K. E. Kress of Firestone Tire and Rubber Co., presents a discussion of techniques involved in spectroscopy and shows the usefulness of absorption spectroscopy as an analytical tool in analysis of rubber products. Identification of accelerators, antioxidants, plasticizers and resins, elastomers, mineral fillers, sulfur and carbon black are given as examples. The subject index of the book is in German and comprises two pages. Literature references are given after each chapter.

It is pointed out in the foreword that the booklet does not claim to be a scientific treatise but merely an aid to laboratory technicians. Although the booklet contains valuable information and useful hints, it is doubtful that the limited material presented would enable a laboratory technician to determine the composition of a competitive product if that should be his assignment. However, the booklet can be quite helpful, particularly to technicians new to the field, especially if used together with the literature references cited and other more complete textbooks on the subject. Considering the briefness of the text, the authors have done an excellent job of discussing the subject matter.

F. R.

•

Block and Graft Polymers. By William J. Burlant and Allen S. Hoffman. Published by Reinhold Publishing Corp., 430 Park Ave., New York 22, N. Y. 6 x 9¼ in. 166 pp. $7.95.

This book summarizes, qualitatively, the reactions and experimental techniques used to initiate block and graft polymerization. It also discusses what is known of the structures of the products and their physical properties. Its purpose is to suggest to scientists and engineers that "molecular engineering" of polymers—the synthesis of macromolecules of known configuration and physical characteristics—is indeed possible.

The nine chapters cover nomenclature, separation and isolation of block and graft polymers, chain transfer reactions, radical attack of unsaturated backbones in natural and synthetic rubber, reactions of macromolecules containing functional groups, photolytic reactions,

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GREEN LABEL No. 43

Medium particle size for easy wetting. In pellet form this grade is particularly advantageous in preparing pourable 70% zinc oxide water dispersions.

GREEN LABEL No. 42

General purpose type. Excellent activating and moderate reinforcing properties. Faster rate of incorporation into rubber than Black Label No. 20 or Red Label No. 30.

GREEN LABEL No. 43

Large particle size type for easy incorporation. Good activating and reinforcing properties.

GREEN LABEL No. 42A-3

Somewhat larger in particle size than Red Label No. 31 for easier incorporation; otherwise, similar in general characteristics.

GREEN LABEL No. 46

Low pH type used in foam latex where zinc oxide is used for both activation and as a supplementary gelling agent.

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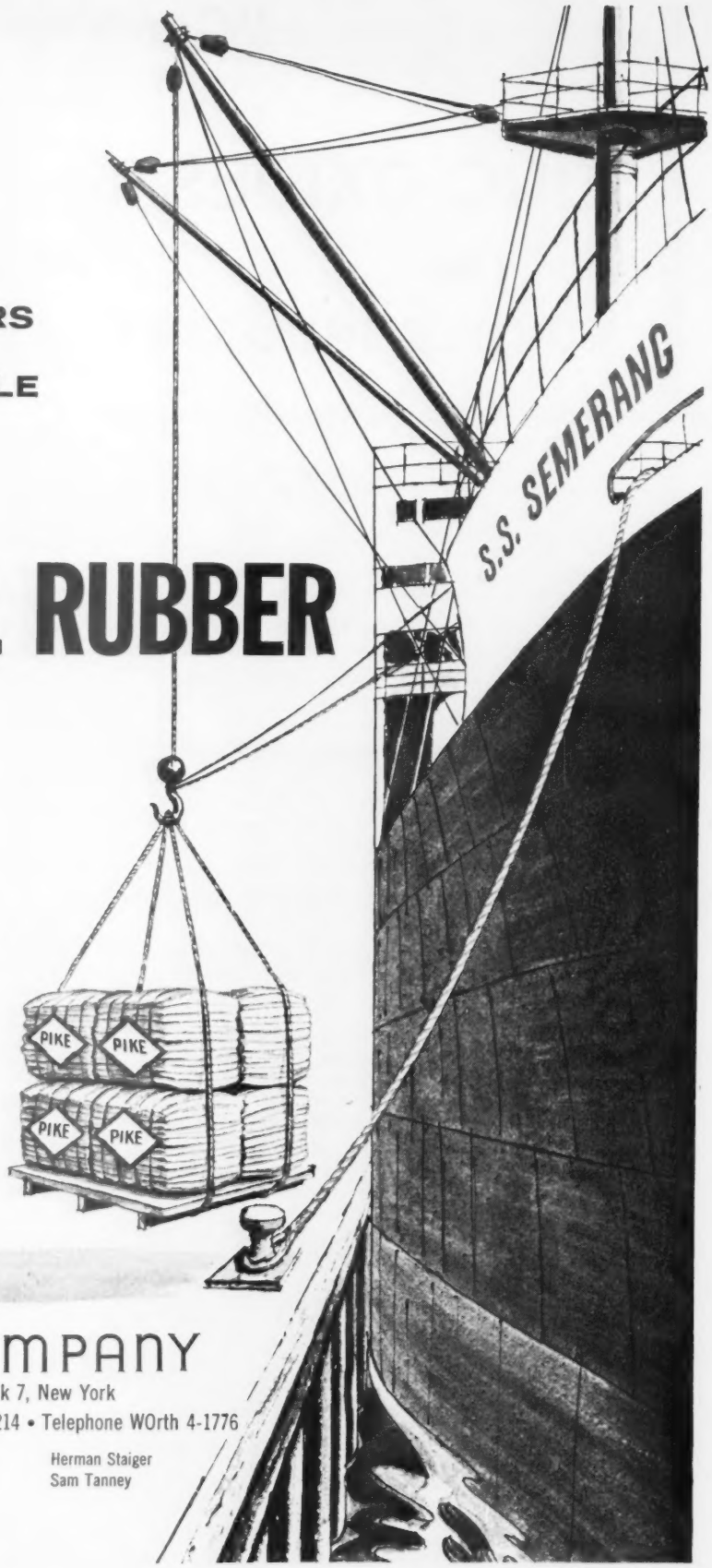

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ionizing radiation, mechanical degradation, and stereoblock polymers.

Block polymers, graft polymers, interpolymers and stereoblock polymers are indexed. If known, the backbone or starting polymer is listed first. Many references are made to rubber and rubberlike elastomers, including styrene-butadiene rubber, acrylonitrile-butadiene rubber, natural rubber, butyl rubber, chlorinated rubber, epoxy resins-nitrile rubber, neoprene, and various starting, intermediate, and end products. Ozonolysis of rubber, reactions with free radicals, and vulcanization of rubber are also mentioned briefly.

BOOKLETS, CATALOGS, etc.

Processing of Texin Solid Urethane Elastomers. (Bulletin TIB 62-E19.) Mobay Chemical Co., Penn Lincoln Parkway West, Pittsburgh 5, Penna. 8½ x 11 in. 9 pp.

This bulletin describes preliminary results in processing solid urethane rubbers by means of thermoplastic equipment. The materials discussed are Texin 280-A and 192-A. It is divided into three main parts: an introduction, a section on Texin 280-A, which is designed for extrusion purposes, and a section on Texin 192-A, suitable for molding as well as extrusion. The introduction summarizes the chief properties of the two fully compounded, partially cured urethane polymers, and the advantages of injection molding and extrusion. In addition, the bulletin contains a brief section on storage stability and an appendix on coloring of Texin parts.

•

The Breon Rubber Story. (Booklet No. XHG1). Information Department, British Geon Limited, Devonshire House, Piccadilly, London, W.1, England. 8¼ x 11½ in. 24 pp.

The booklet shows how Breon nitrile rubbers and latices are making more things possible in many different fields. After an introductory section describing the manufacture and processing of Breon, the literature then shows how its special properties meet the needs of nine different industries, such as: engineering, transport, aircraft, footwear, printing, textile, paper, leather, and adhesives. Each section is well illustrated.

•

Horizontal Mixers. (Bulletin 128-A). Sprout, Waldron & Co., Inc., 130 Logan Street, Muncy, Penna. 8½ x 11 in. 8 pp.

Compact information on modern horizontal mixers is given in this new bulletin. The literature covers a variety of standard and special designs for efficient mixing and blending of chemicals, food, feedstuffs, drugs, dyes, and other products. Illustrated in the bulletin are various types of agitators, drives, discharges, and heating and cooling jackets. A complete specification table gives dimensions, capacities, and horsepower requirements.

•

Molecular Sieves. Linde Co., 270 Park Avenue, New York 17, N. Y. 8½ x 11 in. 12 pp.

The brochure, entitled "Chemical-Loaded Molecular Sieves in Rubber and Plastics," discusses the general properties of the products, with emphasis on its uses in latent curing and such factors as release temperatures versus volatility. There is a section on testing molecular sieves for determining performance, and methods of handling are described. Listed are the types of chemicals that are presently available in chemical-loaded molecular sieves.

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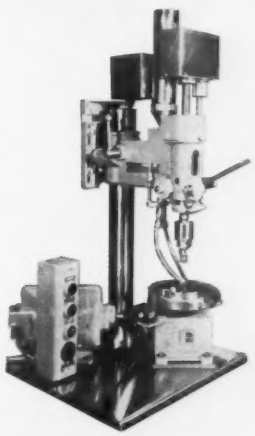

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MARKET REPORTS

TRENDS
NEWS
PRICES

Natural Rubber

The price of natural rubber on the New York Commodity Exchange moved in a range of 150 points since our last report (February 1), high for the period being 30.00c reached on February 27, and low being 28.50c reached on February 1, 3 and 8. The average price of spot rubber for the month of February was 29.00c based on 19 trading days. This compares with an average of 28.77c in the previous month.

New Rubber Contract

The members of the Commodity Exchange have voted to adopt a new rubber contract entitled the "Standard Rubber Contract." The principal feature of the new contract is the broadening of the deliverable base to conform more closely to present conditions in the trade.

Trading in the new contract began on Wednesday, February 15, with the first delivery month May of 1961. Trading may also be conducted for July, September and November, 1961 and January and March, 1962. The "Rex" contract may not be traded beyond the January, 1962 delivery.

The new "Standard" Contract basis grade is No. 1 International Ribbed Smoked Sheets. Rubber inferior to No. 1 R.S.S. is also deliverable at discounts for half-grade and lower than half-grade but not as low as No. 2 R.S.S.

Analysts at Merrill Lynch, Pierce, Fenner & Smith point out that the change from the "Rex" contract was favored by most who felt that this old contract was too limited to be widely used by all segments of the rubber trade and industry. Thus, the new contract has been expanded so that rubber below No. 1 R.S.S. in quality may also be delivered. This could possibly increase the availability of rubber for certification. Until the present time, only about 10 per cent of the rubber tendered for certification was accepted.

Easier Handling

The changes may increase the percentage quite a bit, for stained bales may now amount to 25 per cent of a contract instead of 10 per cent previously. For easier handling, the Exchange now allows delivery of bales weighing as little as 110 pounds. The previous limit was 224 pounds. The top limit remains at 250 pounds.

The Exchange has made arrangements whereby a special commission rate will be allowed for those who wish to switch existing positions into the new contract. A $10.00 commission will be charged as long as the switch is into the same contract month. Any other switches will be subject to regular commissions. In order to take advantage of the special commission rate, orders must be given as switch orders.

NEW YORK, MARCH 1, 1961

Price Data

Closing Rubber Prices on New York Commodity Exchange

FROM FEB. 1 TO FEB. 28

Feb.	Spot	Mar.	May	July	Sales
1	28.50	28.45	27.75	27.70	32
2	28.63	28.80	28.00	28.00	35
3	28.50	28.80	28.00	27.85	27
4	....	....	....	....	..
5	....	....	....	....	..
6	28.63	28.80	27.80	27.70	35
7	28.63	28.80	27.85	27.75	58
8	28.50	28.70	27.90	27.80	31
9	28.88	28.80	28.19	28.05	12
10	29.25	29.15	28.45	28.25	22
11	....	....	....	....	..
12	....	....	....	....	..
13	29.38	29.15	28.75	28.50	61
14	29.38	29.10	28.80	28.55	20
15	29.50	29.20	28.90	28.60	51
16	28.88	28.51	28.35	28.10	94
17	28.63	28.35	28.30	28.00	17
18	....	....	....	....	..
19	....	....	....	....	..
20	28.63	28.35	28.30	28.10	3
21	28.75	28.55	28.49	28.25	10
22	....	....	....	....	..
23	29.13	29.00	28.85	28.70	32
24	29.50	29.30	29.10	28.75	18
25	....	....	....	....	..
26	....	....	....	....	..
27	30.00	29.95	29.55	29.30	35
28	29.75	29.65	29.15	28.87	66

Outside Market

No. 1 Ribbed Smoked Sheets:	
Spot	.29¼
Apr.-June	.29
July-Sept.	.28¾
Thin Latex Crepe:	
Spot	.31¾
Thin Brown Crepe, No. 2	.25
Flat Bark Crepe	.19½

London Market
(Standard Smoked Sheets)

Apr.	28.85 — 29.00
Apr.-June	28.70 — 28.85

Singapore Market
(Standard Smoked Sheets)

Apr.	27.28 — 27.36

Middling Upland Quotations

	Jan. 31	Feb. 28		
	Close	High	Low	Close
Mar.	32.16	32.58	32.51	32.57
May	32.63	33.05	33.00	33.03
July	33.12	33.55	33.51	33.52

Notes & Quotes

Secretary of Commerce Luther Hodges has noted that present government policies, including the export subsidy on cotton sold abroad, "are actually destroying a basic industry"—the American textile industry. For this reason, he said, there is a need for the government to act quickly to see what can be done to help the textile manufacturers. Abolition of the export subsidy for cotton might hurt small farmers, however, the Secretary noted.

Synthetic Rubber

Clayton F. Ruebensaal, director of commercial planning for the Texas-U.S. Chemical Co., writing in a recent issue of *Rubber and Plastics Age (London)*, points out that it has been frequently postulated that the conversion from natural to synthetic-natural polymers would be slowed by a price drop in the natural product.

Although this is true to an extent, he states, there is a counter-balancing factor which should favor a switch to the *cis* diene rubbers and possibly more specifically to the *cis*-polybutadiene types. This factor, declares Mr. Ruebensaal, is their technical superiority which should be significantly and firmly established by 1962.

Sees Dynamic Change

It appears that the revolution experienced in the last half of the past decade foreshadows a total upheaval in world rubber practices. The next five years should be a period of dynamic change which should see:

- Notable increases in per capita consumption of total rubber in most countries and an even faster rate of growth of the synthetic segment.
- An accelerated buildup of synthetic rubber facilities in principal areas around the world.
- The introduction of many new basic types of synthetic elastomers in an effort to tap these markets.
- Major technological improvements in natural rubber attempting to keep old and win new markets.
- Vigorous competition between the two existing synthetic-natural rubbers but growing usage of both.
- Greatly expanded and intensified world trade in synthetic rubber, deviating widely from today's pattern.

Supply and Demand

Mr. Ruebensaal also notes that we should not make the assumption that all exports of synthetic rubber from the United States and Canada will cease in the next few years, or that there will be an excessive world surplus of synthetic capacity.

He points to the fact that most countries have a rather low per capita consumption of total rubber which is growing rapidly. Also to be noted is the rapid conversion to higher percentages of synthetic to total new rubber used and the world's requirements for special purpose synthetics which will not be produced abroad.

In all, concludes the author, the years ahead will be an exciting, fruitful period in which rubber will once again be looked on with favor by the public and investors alike as having all the challenges and glamor of the best of the growth industries.

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Technical Service. By experts, too. In fact, our technical service is backed by more than 30 years of Skelly experience. One more reason?

An Easy-To-Remember Telephone Number: LOgan 1-3575, Kansas City, Missouri. Nothing complicated about that. And by calling that simple number, you can solve your solvent problems! Just ask for Les Weber, and your solvent needs are in mighty good hands.

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SKELLYSOLVE-C. For making quick-setting cements with a somewhat slower drying rate than those compounded with Skellysolve-B. Closed cup flash point about 13° F.

SKELLYSOLVE-H. For general use in manufacturing operations and cements, where faster evaporation rate than that of Skellysolve-C is desired. Closed cup flash point about —16° F.

SKELLYSOLVE-L. For general manufacturing operations where a medium evaporation rate is required. Closed cup flash point about 12° F.

SKELLYSOLVE-R. For general use in tire building and a variety of other manufacturing operations and cements. Reduces evaporation losses. Medium quick final dry. Lessens bloating and skinning tendency. Closed cup flash point about —25° F.

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Marketing Headquarters
Kansas City 41, Missouri

PRICES OF COMMERCIALLY AVAILABLE

Dry Rubber

(per pound carload)

Butadiene-Acrylonitrile Types

Butaprene NF	.4900 [1]
Butaprene NH	.6500 [2]
Butaprene NL	.5000 [1]
Butaprene NXM	.5800 [1]
Chemigum N3NS and N5	.5800 [2]
Chemigum N6	.5000 [2]
Chemigum N6B	.5000 [2]
Chemigum N7	.5000 [2]
Chemigum N8	.5000 [2]
Chemigum N600	.5000 [2]
Herecol N-33	.6800 [1]
Hycar 1001 and 1041	.5800 [1]
Hycar 1002	.5000 [1]
Hycar 1014	.6000 [1]
Hycar 1042 and 1043	.5000 [1]
Hycar 1051	.5800 [1]
Hycar 1052	.5000 [1]
Hycar 1053	.5000 [1]
Hycar 1072	.6400 [1]
Hycar 1203	.4600 [1]
Hycar 1312	.5000 [1]
Hycar 1411	.6200 [1]
Hycar 1432	.5900 [1]
Hycar 1441	.6200 [1]
Paracril AJ	.4850 [1]
Paracril B and BJ	.5000 [1]
Paracril BLT and BJLT	.5000 [1]
Paracril C and CLT	.5800 [1]
Paracril CV	.6300 [1]
Paracril D	.6500 [1]
Paracril 18-80	.6000 [1]
Paracril OZO	.4600 [1]
Polysar Krynac 800	.5000 [1]
Polysar Krynac 801	.5800 [1]
Polysar Krynac 802	.5000 [1]
Polysar Krynac 803	.5000 [1]

Butadiene-Styrene Types

Ameripol 1000	.2410 [2]
Ameripol 1001	.2410 [2]
Ameripol 1002	.2435 [2]
Ameripol 1006	.2410 [2]
Ameripol 1006 (crumb)	.2475 [2]
Ameripol 1007	.2410 [2]
Ameripol 1009	.2475 [2]
Ameripol 1009 (crumb)	.2590 [2]
Ameripol 1011	.2475 [2]
Ameripol 1012	.2425 [2]
Ameripol 1012 (crumb)	.2490 [2]
Ameripol 1013	.2410 [2]
Ameripol 1013 (crumb)	.2615 [2]
Ameripol 1500 and 1501	.2410 [2]
Ameripol 1502	.2410 [2]
Ameripol 1605	.1900 [2]
Ameripol 1703	.2060 [2]
Ameripol 1705	.2035 [2]
Ameripol 1707	.1910 [2]
Ameripol 1708	.1910 [2]
Ameripol 1710	.1885 [2]
Ameripol 1712	.1885 [2]
Ameripol 1805	.1550 [2]
Ameripol 1808	.1480 [2]
Ameripol 1809	.1545 [2]
Ameripol 1810	.1400 [2]
Ameripol 4600	.2410 [2]
Ameripol 4601	.2410 [2]
Ameripol 4604	.2410 [2]
Ameripol 4651	.1770 [2]
Ameripol 4659	.1820 [2]
Ameripol 4660	.1870 [2]
Ameripol 4664	.1845 [2]
Ameripol 4667	.2080 [2]
Ameripol 4700	.1750 [2]
Ameripol 4756	.1545 [2]
Ameripol 4758	.1450 [2]
Ameripol 4759	.1598 [2]
Ameripol 4760	.1576 [2]
Ameripol 4761	.1710 [2]
ASRC 1000	.2410 [2]
ASRC 1001 and 1004	.2410 [2]
ASRC 1006	.2410 [2]
ASRC 1009	.2475 [2]
ASRC 1018	.2700 [2]
ASRC 1019	.2650 [2]
ASRC 1500	.2410 [2]
ASRC 1502	.2410 [2]
ASRC 1503	.2625 [2]
ASRC 1703	.2060 [2]
ASRC 1708	.1910 [2]
ASRC 1712	.1885 [2]
ASRC 1713	.1750 [2]
ASRC 3105 and 3106	.2410 [2]
ASRC 3110	.2600 [2]
Baytown B-129	.1960 [2]
Baytown B-134	.1900 [2]
Baytown B-172	.1825 [2]
Baytown 1600	.1930 [2]
Baytown 1601	.1930 [2]
Baytown 1602	.1930 [2]
Baytown 1801	.1760 [2]
Baytown 1803	.1740 [2]
Baytown 1811	.1569 [2]
Baytown 8675	.1820 [2]
Baytown 8676	.1876 [2]
Baytown 8677	.1820 [2]
Baytown 8678	.2080 [2]
Baytown 8679	.2022 [2]
Baytown 8680	.1775 [2]
Baytown 8681	.1835 [2]
Baytown 8775	.1545 [2]
Baytown 8776	.1679 [2]
Baytown 8777	.1550 [2]
Baytown 8778	.1480 [2]
Baytown 8779	.1496 [2]
Baytown 8780	.1507 [2]
Baytown 8781	.1655 [2]
Baytown 8782	.1583 [2]
Baytown 8783	.1515 [2]
C-102 (Shell)	.2300 [2]
Carbomix 1606	.1820 [2]
Carbomix 1608	.1845 [2]
Carbomix 1609	.2080 [2]
Carbomix 1808	.1480 [2]
Carbomix 1809	.1545 [2]
Carbomix 1811	.1569 [2]
Carbomix 1813	.1640 [2]
Carbomix 1814	.1545 [2]
Carbomix 1815	.1496 [2]
Carbomix 1817	.1715 [2]
Carbomix 3761	.1576 [2]
Carbomix 3764	.1685 [2]
CB-102 (Shell)	.1850 [2]
Copo 1006	.2410 [2]
Copo 1500	.2410 [2]
Copo 1502	.2410 [2]
Copo 1505 NS	.2610 [2]
Copo 1507	.2410 [2]
Copo 1510	.2410 [2]
Copo 1712	.1885 [2]
Copo 1713	.1750 [2]
Copo 1714	.1725 [2]
Copo 1778	.1910 [2]
FR-S 146	.2410 [2]
FR-S 158	.3000 [2]
FR-S 173	.2060 [2]
FR-S 178	.1910 [2]
FR-S 181 and 182	.2410 [2]
FR-S 184	.1885 [2]
FR-S 1000	.2410 [2]
FR-S 1001	.1410 [2]
FR-S 1004 and 1006	.2410 [2]
FR-S 1007	.2410 [2]
FR-S 1009	.2475 [2]
FR-S 1010	.2600 [2]
FR-S 1012	.2425 [2]
FR-S 1013	.2410 [2]
FR-S 1014	.2810 [2]
FR-S 1500 and 1502	.2410 [2]
FR-S 1703	.2060 [2]
FR-S 1710 and 1712	.1885 [2]
Gentro 1500	.2410 [2]
Gentro 1712	.1885 [2]
Gentro-Jet 9152	.2080 [2]
Gentro-Jet 9153	.1820 [2]
Gentro-Jet 9154	.1845 [2]
Gentro-Jet 9250	.1580 [2]
Gentro-Jet 9251	.1640 [2]
Gentro-Jet 9252	.1670 [2]
Gentro-Jet 9275	.1500 [2]
Naugapol 1015	.3500 [2]
Naugapol 1016	.2650 [2]
Naugapol 1018	.2700 [2]
Naugapol 1019	.2650 [2]
Naugapol 1022	.3050 [2]
Naugapol 1023	.3300 [2]
Naugapol 1503	.2625 [2]
Naugapol 1504	.3500 [2]
Naugapol 6003	.2700 [2]
Naugapol 6100	.3200 [2]
OB-102 (Shell)	.1825 [2]
OB-104 (Shell)	.1475 [2]
OB-106 (Shell)	.1510 [2]
OB-110 (Shell)	.1410 [2]
OB-111 (Shell)	.1540 [2]
OB-113C (Shell)	.1750 [2]
OB-114C (Shell)	.1420 [2]
OB-116 (Shell)	.1810 [2]
Philprene 1000	.2410 [1]
Philprene 1006	.2410 [1]
Philprene 1009	.2475 [1]
Philprene 1018	.2700 [1]
Philprene 1019	.2650 [1]
Philprene 1500 and 1502	.2410 [2]
Philprene 1503	.2625 [1]
Philprene 1601	.1930 [1]
Philprene 1603	.1960 [1]
Philprene 1605	.1900 [1]
Philprene 1606	.1820 [1]
Philprene 1608	.1845 [1]
Philprene 1609	.2080 [1]
Philprene 1703	.2060 [1]
Philprene 1708	.1910 [1]
Philprene 1712	.1885 [1]
Philprene 1803	.1740 [1]
Philprene 1805	.1550 [1]
Philprene 1808	.1480 [1]
Plioflex 1006	.2410 [2]
Plioflex 1500C	.2410 [2]
Plioflex 1502	.2410 [2]
Plioflex 1507	.2410 [2]
Plioflex 1508	.2410 [2]
Plioflex 1510	.2410 [2]
Plioflex 1710C and 1712C	.1885 [2]
Plioflex 1713	.1750 [2]
Plioflex 1714C	.1725 [2]
Plioflex 1773	.2060 [2]
Plioflex 1778	.1910 [2]
Polysar Kryflex 200	.2510 [2]
Polysar Krylene	.2410 [2]
Polysar Krylene NS	.2410 [2]
Polysar Krynol 651	.1885 [2]
Polysar Krynol 652	.1910 [2]
Polysar S-630	.2410 [2]
Polysar S-X 371	.2550 [2]
Polysar SS-250	.2875 [2]
S-1000	.2410 [2]
S-1002	.2435 [2]
S-1006	.2410 [2]
S-1009	.2475 [2]
S-1011	.2475 [2]
S-1013	.2410 [2]
S-1500	.2410 [2]
S-1502	.2410 [2]
S-1509	.2410 [2]
S-1703	.2060 [2]
S-1707	.1910 [2]
S-1709	.1885 [2]
S-1710	.1885 [2]
S-1712	.1885 [2]
S-1778	.1910 [2]
S-7501	.2410 [2]
S-7652	.1960 [2]
S-7702	.1750 [2]
SP-102	.3000 [2]
SP-103	.3000 [2]
Synpol 1000 and 1001	.2410 [2]
Synpol 1002	.2435 [2]
Synpol 1006	.2410 [2]
Synpol 1007	.2410 [2]
Synpol 1009	.2475 [2]
Synpol 1012	.2425 [2]
Synpol 1013	.2410 [2]
Synpol 1061	.2410 [2]
Synpol 1500	.2410 [2]
Synpol 1502	.2410 [2]
Synpol 1551	.2410 [2]
Synpol 1703	.2060 [2]
Synpol 1707	.1910 [2]
Synpol 1708	.1910 [2]
Synpol 1712	.1885 [2]
Synpol 8103	.2401 [2]
Synpol 8151	.1820 [2]
Synpol 8152	.1860 [2]
Synpol 8200	.1910 [2]
Synpol 8201	.1750 [2]
Synpol 8202	.1725 [2]
Synpol 8208	.1750 [2]
Synpol 8255	.1480 [2]
Synpol 8253	.1584 [2]
Synpol 8254	.1545 [2]
Synpol 8266	.1598 [2]
Synpol 8267	.1640 [2]

Butyl Rubbers

Enjay Butyl 035 and 150	.2300 [2]
Enjay Butyl 165 NS	.2400 [2]
Enjay Butyl 215	.2300 [2]
Enjay Butyl 217	.2300 [2]
Enjay Butyl 218	.2300 [2]
Enjay Butyl 268 NS	.2400 [2]
Enjay Butyl 325	.2300 [2]
Enjay Butyl 365 NS	.2400 [2]
Polysar Butyl 100	.2450 [2]
Polysar Butyl 101	.2775 [2]
Polysar Butyl 200 and 300	.2450 [2]
Polysar Butyl 301	.2550 [2]
Polysar Butyl 400	.2450 [2]

Chlorosulfonated Polyethylene

Hypalon 20	.4700 [2]
Hypalon 30	.6000 [2]
Hypalon 40	.5000 [2]

SYNTHETIC RUBBER POLYMERS

Fluoroelastomers

Fluorel	$10.25 [2]
Kel-F 3700 and 5500	$16.00 [2]
Viton A and A-HV	$10.00 [2]
Viton B	$13.00 [2]

Neoprene

	(prices f.o.b.)
Neoprene Types AC and CG	.5500 [1]
Neoprene Type AD	.5500 [1]
Neoprene Type FB	.6500 [1]
Neoprene Type GN	.4100 [1]
Neoprene Type GN-A	.4100 [1]
Neoprene Type GRT	.4200 [1]
Neoprene Type KNR	.7500 [1]
Neoprene Type S	.4200 [1]
Neoprene Type W	.3900 [1]
Neoprene Type WB	.4100 [1]
Neoprene Type WHV	.3900 [1]
Neoprene Type WRT	.4500 [1]
Neoprene Type WX	.4100 [1]

Polysulfide Rubbers

	(prices f.o.b.)
Thiokol Type A	.5000 [1]
Thiokol Type FA	.6900 [1]
Thiokol Type ST	1.2500 [1]

Silicone Rubbers*

	(prices f.o.b.)
GE (compounded)	2.50 [1]
GE Silicone Gum (not compounded)	4.00 [1]
Silastic (compounded)	2.50 [1]
Silastic (gums)	4.00 [1]
Union Carbide (gums)	4.00 [1]
Union Carbide (compounds)	2.50 [1]

Latex

(per pound carload)

Butadiene-Acrylonitrile Types

Butaprene N-300	.4600 [1]
Butaprene N-400 and N-401	.5400 [1]
Chemigum 200	.4800 [1]
Chemigum 235	.5300 [1]
Chemigum 236	.5300 [1]
Chemigum 245	.4500 [1]
Chemigum 246	.4500 [1]
Chemigum 247	.4500 [1]
Chemigum 248	.4500 [1]
Hycar 1512	.4500 [1]
Hycar 1551	.5300 [1]
Hycar 1552	.4500 [1]
Hycar 1561	.5300 [1]
Hycar 1562	.4500 [1]
Hycar 1571	.5300 [1]
Hycar 1572	.4500 [1]
Hycar 1577	.4500 [1]
Nitrex 2612	.4500 [1]
Nitrex 2616	.5300 [1]
Nitrex 2620	.4500 [1]
Nitrex 2625	.4500 [1]
Tylac 640 and 650	.4500 [1]
Tylac 750	.4900 [1]
Tylac 850	.5300 [1]
Tylac 1640 and 1650	.5400 [1]

Butadiene-Styrene Types

CL-101 (Shell)	.2800 [1]
Copo 2000	.2750 [2]
Copo 2101	.3000 [1]
Copo 2102	.3200 [1]
Copo 2105	.3200 [1]
Copo 2108	.3000 [1]
Copo 2109	.2775 [1]
Copo 2110	.3200 [1]
Copo 3852	.3000 [1]
FR-S 110	.3000 [1]
FR-S 150	.3000 [1]
FR-S 151	.2900 [1]
FR-S 174	.2950 [1]
FR-S 176	.2775 [1]
FR-S 2000	.2775 [1]
FR-S 2001	.2775 [1]
FR-S 2002	.3000 [1]
FR-S 2003	.3050 [1]
FR-S 2004	.3050 [1]
FR-S 2006	.2900 [1]
FR-S 2105	.3200 [1]
Naugatex 2000 and 2001	.2750 [1]
Naugatex 2002	.3000 [1]
Naugatex 2006	.2900 [1]
Naugatex 2105 and 2107	.3200 [1]
Naugatex 2108	.3000 [1]
Naugatex 2113	.2900 [1]
Naugatex J-8174-F	.3200 [1]
Naugatex J-8855	.3000 [1]
Naugatex J-9049	.2750 [1]
Naugatex J-9064	.3050 [1]
Pliolite 2000	.2775 [1]
Pliolite 2001	.2775 [1]
Pliolite 2076	.2900 [1]
Pliolite 2104	.3200 [1]
Pliolite 2105	.3200 [1]
Pliolite 2107	.3200 [1]
Pliolite 2108	.3000 [1]
S-2000 and S-2006	.2600 [1]
S-2101	.2600 [1]
S-2105	.2800 [1]
S-2108	.2900 [1]
Tylac 400	.3000 [1]
Tylac 410 and 420	.2900 [1]
Tylac 450-A	.2750 [1]
Tylac 3040 and 3340	.3200 [1]

Neoprene

Neoprene Latex 60	.4000 [1]
Neoprene Latex 571	.3700 [1]
Neoprene Latex 572	.3900 [1]
Neoprene Latex 601-A	.4000 [1]
Neoprene Latex 673	.5000 [1]
Neoprene Latex 735	.3800 [1]
Neoprene Latex 736	.3800 [1]
Neoprene Latex 842-A	.3700 [1]
Neoprene Latex 950	.4700 [1]

Polysulfide Rubbers

Thiokol Type MX	.8000 [1]
Thiokol Type WD-2	1.2500 [1]
Thiokol Type WD-6	.8000 [1]

Notes: (1) Freight allowed. (2) Freight extra. (3) Freight prepaid. *Covers a wide range of compounds. Readers are urged to check specific prices with producers.

Suppliers are your Materials Listed in the Market Prices Section?
If not, forward full information to —
Market Editor

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MARKETS

(continued)

Reclaimed Rubber

Although pertinent figures are lacking, it does not seem as if the reclaimed rubber industry made too auspicious an entry into the new year. Automobile production figures for the first two months of the year are disheartening. In February alone, production was down nearly 300,000 units from February, 1960. There is now an inventory of unsold cars of 1,035,000, with automobile plants working at 44 per cent of the February, 1960 rate. It should be noted that the 1961 figures represent more than 70 production days.

With these figures in mind, it is difficult at this point to be overly optimistic about total rubber consumption and, of course, reclaimed rubber consumption. Just a few months ago it was estimated by most pundits that consumption in 1961 would top 1960's 279,000 long tons. No one is so sure now.

(Prices for All Areas Except West Coast)
(Average price, carload quantities, minimum freight allowed)

	per lb.
First Line Whole Tire	.11½
First Line Whole Tire Stainless	.12¼
Second Line Whole Tire	.11
Third Line Whole Tire	.10¾
Fourth Line Whole Tire	.10¼
Black Carcass	.15¾
Peelings	.11½
Butyl Tube	.16
Natural Rubber Black Tube	.17
Natural Rubber Red Tube	.21
Mechanical, Light Color, Low Gravity	.26
Mechanical, Light Color, Medium Gravity	.20

Scrap Rubber

The scrap rubber market has been rather a dull affair during the past month. Heavy snows played havoc with most northern markets, not only halting collections but severely hampering deliveries. Movement of material has generally been described as moderate in volume and prices have remained fairly steady.

What happens from here on out is contingent upon the same economic factors which affect the rest of the rubber industry (see column above). At this point we can only assume that scrap rubber consumption will fall below last year's 266,000 long tons.

(Prices Delivered Akron)

Mixed tires	ton	14.00
Lighting colored carcass	lb.	.06
No. 1 peelings	ton	38.00
No. 2 peelings	ton	27.00
No. 3 peelings	ton	20.00
Buffings	ton	14.00
Truck and Bus S.A.G.	ton	20.00
Passenger S.A.G.	ton	20.00
Natural Rubber Red Tubes	lb.	.07½
Natural Rubber Black Tubes	lb.	.07
Butyl Rubber Tubes	lb.	.06¼

Tire Fabrics

The price of high tenacity rayon tire cord has been raised two cents a pound by several producers. American Enka got the move underway stating that the reason for the price increase was "because we haven't been able to make enough money at the price we have been selling it."

Shortly after the Enka announcement, DuPont and Beaunit Mills also raised their prices and it is expected that other producers will shortly follow suit.

Some observers are stating that the rayon tire cord industry is passing along to consumers the cost of waging its war on nylon yarn producers. It is to be noted that one of the rayon cord producers stated that his two-cent price increase would be spent on advertising.

Optimistic Figures

Tyrex, Inc. is pointing with optimism to the latest figures from the Bureau of the Census which show that rayon tire cord output jumped 5 per cent in the last quarter of 1960 for a gain of about 2,500,000 pounds.

The increase took place despite a drop in total tire cord production from the third quarter. Rayon tire cord and tire cord fabric production at the end of the fourth period was 54,388,000 pounds, compared with 51,830,000 pounds for the third period.

The Tyrex rayon cord gain was apparently made at the expense of nylon tire cord, or so Tyrex, Inc. assumes. During the same period, the production of nylon tire cord and tire cord fabric decreased 12 per cent. Output of nylon tire cord in the fourth quarter was 28,897,000 pounds, down 4,003,000 pounds from the third period.

DuPont, meanwhile, points to the fact that in 1960, for the first time, more than half the replacement truck tires sold in the United States were made with nylon cord. More than 30 per cent of original equipment truck tires also were made with nylon. In 1955, approximately 15 per cent of replacement truck tires were made with nylon, and about 5 per cent of original equipment tires were nylon. By 1957, nylon accounted for 33 per cent of replacement truck tires and in 1959, its share had risen to 47 per cent.

(Prices f.o.b. Shipping Point)

Rayon Tire Cord

1100	lb.	.57
1650	lb.	.51
2200	lb.	.50

Nylon Tire Cord

840	lb.	.92
1680	lb.	.92

Rayon Graded Fabric

1100	lb.	.69
1650	lb.	.63½
2200	lb.	.63

Cotton Chafers

8.9 oz. (per square yard)	lb.	.71
9.25 oz. (per square yard)	lb.	.72
11.65 oz. (per square yard)	lb.	.66
14.4 oz. (per square yard)	lb.	.75

Liquid Latex

Natural: The entire economy, not only the rubber industry, is going through a "wait and see" period. Not too much of a definitive nature can be reported for the natural latex segment. Last month, natural latex was selling at a 35-36c level at East Coast ports in car load lots and this month natural nylon, and about 5 per cent of original latex is selling at approximately a 36 to 37c a pound level.

If price were the only and the major factor we could logically assume that more latex would have moved last month than this. But this is hardly the case.

It will be remembered that in 1960, about 51,000 long tons of natural latex were consumed in the United States. It was generally expected that consumption would edge upward, in some small degree, in 1961. What we know to date would not justify that sentiment. Realities permit neither joy or pessimism. And so, like the rest of industry, natural latex will have to "wait and see."

Synthetic: It is generally held that if the current state of affairs do not indicate much of an increase in synthetic latex consumption, neither can it be said that they mean much of a decrease in consumption. Synthetic latices enjoy a fairly stable price structure. Prices give every indication of remaining stable. Here too, however, as with natural latex, we shall have to await future developments before any clear trend lines can safely be ascertained.

Cotton

The price of middling uplands on the New York Cotton Exchange moved in a range of 270 points since our last report (February 1), high for the period being February 28 when the price reached 33.00c and low being 30.30c reached on February 13. The average price of middling uplands for the month of February was 32.35c based upon 19 trading days. This compares with an average of 32.25c in the previous month.

The new cotton export subsidy program, which goes into effect on August 1, probably will result in a slowdown of exports in the present season, according to trade sources. Under the new program, higher subsidy payments will be made after the August 1 date.

From the practical standpoint, according to Agriculture Secretary Orville Freemen, there should be little change in the export price of cotton, even though the subsidy will increase from 6c to 8.5c. This is caused by the fact that the new support level will be 2c to 3c higher than the price at which the Commodity Credit Corporation was selling its cotton stocks.

Observers point out that exporters, where possible, may attempt to hold up shipments purchased at present lower support levels until after August 1 to take advantage of higher subsidy payments next season.

a technique for producing IDEAS

One of the giants of creative advertising wrote a book some twenty years ago under the title that heads this page. Although the very idea may seem strange at first, it does work.

Reduced to its bare bones, the technique goes something like this: Gather all possible information on a problem, think hard about it, then put it out of your conscious mind. Finally, you'll find ideas coming to you.

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* The author, by the way, is James Webb Young and, although we sell all kinds of books, we do *not* handle this one. It's available (Ninth Edition) for $2 from Advertising Publications, Inc., 200 East Illinois St., Chicago, Ill.

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361

STATISTICS of the industry

PERTINENT INDUSTRY DATA

Natural Rubber in the United States

(Including Latex and Guayule)

(All Quantities in Long Tons)

Year	New Supply	Consumption	Re-Exports	Stocks On Hand at End of Period
1934	463,018	462,500	23,856	355,000
1935	467,146	495,500	11,391	303,000
1936	488,145	575,000	12,582	223,000
1937	600,479	543,600	7,902	262,204
1938	411,983	437,031	5,652	231,500
1939	499,473	592,000	13,125	125,800
1940	818,243	648,500	7,060	288,864
1941	1,029,007	775,000	5,376	533,344
1942	282,653	376,791	10,856	422,714
1943	55,329	317,634	20,815	139,594
1944	107,834	144,113	9,665	93,650
1945	135,672	105,429	6,743	118,715
1946	400,687	277,597	4,338	237,467
1947	688,354	562,661	4,101	129,038
1948	735,227	627,332	6,673	141,541
1949	660,792	574,522	6,253	106,619
1950	802,249	720,268	8,644	89,215
1951	733,048	454,015	2,603	76,569
1952	805,997	453,846	3,024	95,260
1953	647,150	553,473	8,376	112,316
1954	596,848	596,285	7,443	104,543
1955	635,174	634,800	10,611	110,105
1956	580,510	563,095	11,300	115,949
1957	499,121	539,761	10,146	100,901
1958	474,409	484,492	20,085	76,491
1959	526,048	555,044	18,750	79,405
1960:				
Jan.	34,795	46,354	1,373	76,156
Feb.	40,949	46,022	1,448	75,320
Mar.	38,580	47,205	1,522	81,599
Apr.	36,344	42,032	803	83,451
May	32,018	41,263	840	82,693
June	31,639	42,576	509	76,605
July	28,555	35,229	1,488	76,389
Aug.	39,596	37,258	912	82,385
Sept.	31,862	36,770	754	82,227
Oct.	24,594	26,312	1,150	76,116
Nov.	30,411	40,965	1,177	71,608

Source: U. S. Department of Commerce.

U. S. Imports of Natural Rubber

Year	Dry: Long Tons	Dry: Declared Value	Latex: Long Tons	Latex: Declared Value	Total Imports
1942	266,276	112,537,426	10,646	5,630,667	276,922
1943	50,358	31,369,198	1,890	1,312,202	52,248
1944	103,847	73,908,549	3,091	2,092,211	106,938
1945	134,408	95,814,102	4,773	3,115,853	139,181
1946	376,502	228,796,110	8,421	5,843,085	384,923
1947	691,087	306,951,814	17,542	9,787,722	708,629
1948	702,293	290,849,177	32,745	18,288,223	735,038
1949	630,808	225,343,624	29,743	14,968,650	660,551
1950	747,109	416,222,598	54,401	41,764,486	801,510
1951	677,874	727,343,348	54,963	80,178,309	732,837
1952	756,987	578,179,519	48,228	40,563,116	805,215
1953	571,635	284,909,223	75,511	46,353,333	647,146
1954	522,364	219,098,143	74,483	42,755,029	596,847
1955	542,507	360,435,303	92,825	80,163,114	635,332
1956	499,479	334,990,045	71,709	61,795,844	564,321
1957	475,958	291,337,628	78,567	58,249,788	554,174
1958	406,059	153,127,066	67,593	45,047,040	473,652
1959	498,749	304,594,223	79,205	60,939,662	577,954
1960:					
Jan.	29,455	22,167,388	5,340	4,690,413	34,795
Feb.	35,137	27,281,957	5,812	5,411,873	40,949
Mar.	33,453	26,696,437	5,128	4,659,021	38,581
Apr.	31,408	25,659,607	4,940	4,690,140	36,348
May	26,637	21,962,099	5,830	4,853,091	32,467
June	28,304	23,661,317	3,335	3,152,266	31,639
July	25,072	21,637,414	3,483	3,735,694	28,555
Aug.	35,423	28,919,412	4,174	3,825,191	39,597
Sept.	24,848	23,321,841	2,541	2,259,381	27,389
Oct.	24,866	17,985,313	2,042	1,615,488	26,908
Nov.	26,955	17,654,645	3,456	2,786,602	30,411

Source: Bureau of the Census, U. S. Department of Commerce.

World Production of Natural Rubber

(Including Latex)

(Long Tons)

Year	Malaya	Indonesia	Ceylon	Viet Nam & Cambodia	Laun America*	Rest of World*	Total*
1953	574,390	692,164	98,610	74,545	35,318	250,182	1,725,000
1954	584,435	738,670	93,935	78,024	26,833	280,112	1,802,500
1955	639,128	733,786	93,830	80,172	6,000	344,584	1,897,500
1956	568,550	686,667	95,389	89,072	22,457	336,015	1,857,000
1957	638,706	684,515	98,164	58,440	28,351	381,824	1,890,000
1958	663,644	614,561	100,196	103,613	26,268	446,718	1,955,000
1959	698,249	721,359	91,696	108,398	23,962	421,336	2,065,000
1960:							
Jan.	64,948	45,928	10,875	10,305	4,003	33,941	170,000
Feb.	54,544	50,274	4,285	949	3,667	38,781	152,500
Mar.	54,946	50,567	10,199	2,941	3,493	40,354	162,500
Apr.	46,917	55,143	9,006	7,325	2,498	34,111	155,000
May	56,839	48,985	4,521	10,632	2,498	36,525	160,000
June	58,301	48,774	7,652	10,850	600	33,823	160,000
July	63,146	46,018	6,689	10,802	600	27,745	155,000
Aug.	62,164	34,117	8,394	10,276	600	36,949	152,500
Sept.	61,786	53,050	6,502	10,055	600	40,507	172,500
Oct.	63,109	54,153	9,121	16,076	600	26,941	170,000

Source: International Rubber Study Group. * Estimated.

World Consumption of Natural and Synthetic Rubber

(Including Latex)

(Long Tons)

Year	United States	United Kingdom	Canada	Europe*	Rest of World*	Total*
1951	1,214,298	238,101	70,809	476,500	314,941	2,312,500
1952	1,261,413	202,179	67,099	550,000	254,901	2,335,000
1953	1,338,309	211,453	73,394	521,000	343,606	2,500,000
1954	1,233,012	247,612	71,656	544,250	408,094	2,505,000
1955	1,529,699	266,804	84,528	630,000	464,250	2,980,000
1956	1,436,482	232,345	91,458	775,500	489,215	3,025,000
1957	1,464,640	239,021	88,379	777,250	565,710	3,135,000
1958	1,364,404	238,439	83,904	905,000	638,353	3,230,000
1959	1,626,370	259,655	101,484	985,250	689,741	3,662,500
1960:						
Jan.	141,487	23,087	8,138	82,750	69,538	325,000
Feb.	139,225	22,861	8,733	78,000	68,681	317,500
Mar.	144,932	27,853	8,872	79,750	56,093	317,500
Apr.	132,284	21,946	7,106	71,000	72,664	305,000
May	133,256	23,340	7,051	82,000	61,853	307,500
June	138,425	26,328	8,196	96,750	67,801	337,500
July	114,642	18,991	6,393	83,000	66,974	290,000
Aug.	125,836	17,266	6,253	78,750	66,895	295,000
Sept.	124,100	28,020	7,940	.....	154,940	315,000

Source: International Rubber Study Group. * Estimated.

Rim Production

	1956	1957	1958	1959	1960
Passenger Car	27,109,610	27,301,567	20,665,688	25,412,177	29,288,767
Truck & Bus	6,315,428	5,468,223	3,887,910	5,019,261	4,874,401
Agricultural	1,416,938	1,368,127	1,218,240	1,386,866	827,945
Earth Mover	88,812	67,289	61,883	111,077	93,971
Total	34,930,788	34,205,206	25,833,721	31,929,381	35,091,084

	1960 Aug.	Sept.	Oct.	Nov.	Dec.	1961 Jan.
Passenger Car	1,463,423	2,155,072	2,579,065	2,447,595	2,236,677	1,990,465
Truck and Bus	268,438	281,039	269,749	258,821	224,577	280,801
Agriculture	37,514	43,697	36,798	36,397	48,306	82,548
Earth Mover	9,249	3,996	9,850	2,638	5,144	8,069
Total	1,778,624	2,483,804	2,895,462	2,745,451	2,514,704	2,361,883

Source: The Tire & Rim Association, Inc.

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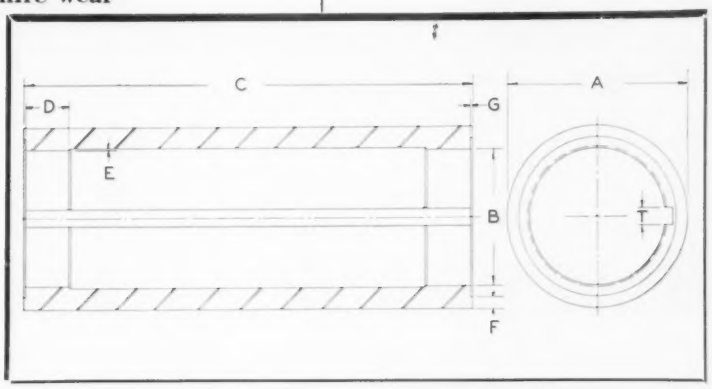

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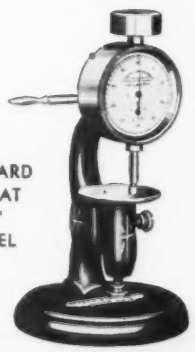

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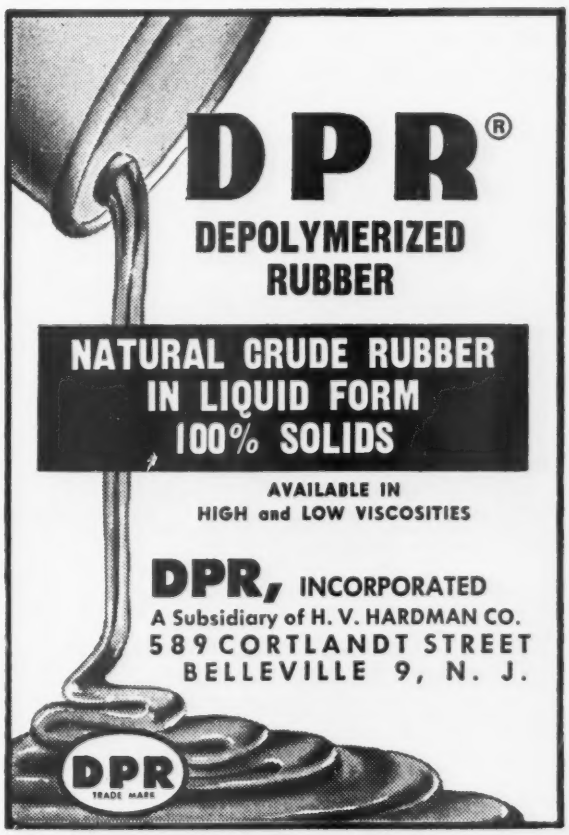

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DPR TRADE MARK

Synthetic Rubber in the United States

(All Quantities in Long Tons)

New Supply

Year	GR-S	Neoprene	Butyl	N-Type	Total
1952	654,854	65,745	81,630	16,228	818,447
1953	680,728	80,495	79,801	20,198	861,222
1954	490,405	69,150	58,802	21,396	639,753
1955	801,145	91,357	36,179	32,623	982,304
1956	876,982	99,412	75,873	34,547	1,086,814
1957	913,321	110,721	67,418	33,618	1,125,078
1958	872,565	97,806	54,113	32,431	1,056,915
1959	1,134,379	124,815	82,704	43,588	1,385,486
1960:					
Jan.	107,519	11,958	8,325	3,808	131,610
Feb.	105,030	12,106	6,917	3,126	127,179
Mar.	110,239	11,305	7,828	3,613	132,985
Apr.	98,464	11,879	8,144	3,130	121,617
May	102,850	11,401	10,115	3,113	127,479
June	99,175	11,614	9,723	2,891	123,403
July	95,892	10,210	8,484	2,519	117,105
Aug.	99,213	10,120	9,999	3,247	122,579
Sept.	90,607	10,078	9,406	3,211	113,302
Oct.	88,451	11,219	8,906	3,226	111,802
Nov.	87,938	11,261	8,605	3,327	111,131

Consumption

1953	624,181	65,900	77,826	16,929	784,836
1954	500,345	57,203	81,404	17,715	636,727
1955	741,997	72,876	53,941	26,035	894,899
1956	727,789	74,847	49,615	24,976	877,267
1957	767,218	75,461	55,413	25,187	923,279
1958	730,196	69,694	53,432	26,590	880,912
1959	886,275	84,955	65,454	34,638	1,071,322
1960:					
Jan.	78,891	7,361	6,093	2,788	95,133
Feb.	76,999	7,369	6,070	2,765	93,203
Mar.	81,065	7,693	6,324	2,645	97,727
Apr.	75,849	6,525	5,492	2,386	90,252
May	77,423	6,471	5,602	2,497	91,993
June	80,951	7,129	5,150	2,619	95,849
July	67,853	4,936	4,597	2,027	79,413
Aug.	73,761	7,200	4,880	2,737	88,578
Sept.	72,593	7,096	4,901	2,740	87,330
Oct.	74,606	6,920	4,552	2,706	88,784
Nov.	72,702	6,372	4,455	2,650	86,179

Exports

1953	7,692	11,494	237	3,245	22,668
1954	11,069	12,062	2,831	4,155	30,117
1955	60,704	18,098	9,895	4,593	93,290
1956	112,366	21,909	8,699	6,194	149,168
1957	157,977	30,242	8,748	6,377	203,344
1958	142,069	31,347	13,793	6,718	193,917
1959	211,300	39,551	21,700	8,256	280,843
1960:					
Jan.	21,967	4,185	2,396	527	29,075
Feb.	22,791	4,588	1,528	740	29,647
Mar.	27,081	4,874	1,803	532	34,290
Apr.	28,765	5,268	2,006	676	36,715
May	23,337	4,213	1,936	1,320	30,806
June	23,130	3,699	2,062	464	29,355
July	19,721	4,446	3,792	616	28,575
Aug.	22,753	3,519	3,494	501	30,267
Sept.	16,836	3,340	3,500	389	24,065
Oct.	72,702	6,372	4,455	2,650	86,179

Stocks

1952	83,861	8,535	22,716	3,875	118,987
1953	135,153	11,480	24,866	4,346	175,845
1954	115,499	11,349	19,267	4,280	150,395
1955	108,989	12,220	10,500	6,030	137,739
1956	151,763	14,077	28,744	7,934	202,518
1957	140,199	18,843	31,489	7,454	197,985
1958	143,533	15,688	18,770	7,292	185,283
1959	174,606	14,164	13,188	8,888	210,846
1960:					
Jan.	183,242	15,143	14,039	9,198	221,622
Feb.	186,166	13,930	12,735	8,352	221,183
Mar.	189,308	13,491	12,764	8,175	223,738
Apr.	185,464	13,796	14,021	8,230	221,511
May	188,808	14,243	16,014	8,267	227,332
June	183,996	15,411	18,912	7,713	226,032
July	192,552	16,954	18,689	7,498	235,693
Aug.	198,695	16,072	20,877	7,096	242,740
Sept.	198,067	16,590	21,271	7,031	242,959
Oct.	192,090	16,405	23,205	6,891	238,591
Nov.	189,466	18,056	25,594	6,922	240,038

Source: U. S. Department of Commerce.

Natural and Synthetic Rubber Latex in the United States

(All Quantities in Long Tons)

New Supply

Year	Natural	GR-S	Neoprene	N-Type	Total Synthetic	Grand Total
1947	17,675	22,474	6,089	.....	28,563	46,238
1948	32,630	21,494	5,022	.....	26,516	59,146
1949	29,974	21,357	3,651	.....	25,008	54,982
1950	54,401	31,339	5,725	.....	37,064	91,465
1951	54,963	32,972	6,866	2,948	42,786	97,749
1952	48,228	42,273	7,598	4,164	54,035	102,263
1953	75,511	48,112	9,026	5,844	62,982	138,493
1954	74,483	48,379	8,214	6,866	63,459	137,942
1955	92,754	69,364	10,432	10,798	90,594	183,348
1956	72,013	69,720	10,642	10,650	91,012	163,025
1957	72,252	74,535	10,403	11,420	96,358	168,610
1958	67,591	65,669	10,679	11,560	87,908	155,499
1959	72,502	93,303	13,127	14,034	120,464	192,966
1960:						
Jan.	5,339	9,720	1,154	1,131	12,005	17,344
Feb.	5,812	9,862	1,085	1,098	12,045	17,857
Mar.	5,127	9,351	1,004	1,217	11,572	16,699
Apr.	4,935	9,408	1,137	917	11,462	16,397
May	5,380	8,162	1,250	1,009	10,421	15,801
June	3,335	7,541	965	973	9,479	12,814
July	3,483	6,481	953	983	8,417	11,900
Aug.	4,174	8,096	978	1,291	10,365	14,539
Sept.	2,541	9,397	1,119	1,299	11,815	14,356
Oct.	2,042	9,063	1,272	1,176	11,511	13,553
Nov.	3,456	7,205	1,169	1,328	9,702	13,158

Consumption[1]

1948	28,489	21,500	5,250	....	26,750	55,239
1949	36,117	21,500	3,750	....	25,250	61,367
1950	56,138	31,000	5,500	....	36,500	92,638
1951	46,750	31,031	6,279	2,628	39,938	86,688
1952	53,567	40,562	7,368	3,093	51,023	104,590
1953	67,375	46,473	7,981	3,654	58,108	125,483
1954	75,931	44,173	7,251	4,507	55,931	131,862
1955	86,478	63,982	8,736	8,495	81,213	167,691
1956	74,082	62,762	8,708	8,021	79,491	153,573
1957	75,009	68,305	9,039	8,630	85,974	160,983
1958	70,183	60,283	9,555	10,549	80,387	150,570
1959	71,745	80,646	11,394	13,258	105,298	177,043
1960:						
Jan.	5,491	8,094	999	1,117	10,210	15,701
Feb.	5,463	7,838	969	1,000	9,807	15,270
Mar.	4,847	8,104	1,076	927	10,107	14,954
Apr.	4,199	7,154	913	976	9,043	13,242
May	3,655	6,821	868	978	8,667	12,322
June	3,975	7,147	1,033	981	9,161	13,136
July	2,912	5,433	729	780	6,942	9,854
Aug.	3,897	7,857	1,057	1,078	9,992	13,889
Sept.	4,250	7,458	942	1,122	9,522	13,772
Oct.	4,283	7,371	971	1,118	9,460	13,743
Nov.	4,338	7,171	914	1,104	9,189	13,527

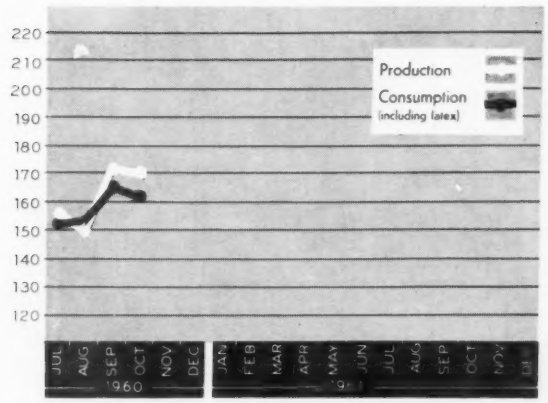
Stocks at End of Period

1948	11,235	....	....	....	....	11,235
1949	5,063	....	....	....	....	5,063
1950	4,927	....	....	....	....	4,927
1951	4,752	3,727	1,245	532	5,504	10,256
1952	6,201	5,040	1,019	902	6,961	13,162
1953	13,532	4,794	1,117	721	6,632	20,164
1954	11,133	5,134	1,087	811	7,032	18,165
1955	13,203	6,980	1,236	1,807	10,203	23,406
1956	12,064	7,451	1,384	1,558	10,393	22,457
1957	14,454	8,347	1,267	1,974	11,588	26,042
1958	8,900	7,672	1,663	2,519	11,854	20,754
1959	12,717	8,226	1,581	2,883	12,690	25,067
1960:						
Jan.	12,781	7,781	1,680	2,799	12,260	25,041
Feb.	12,974	8,606	1,534	2,535	12,675	25,649
Mar.	13,964	8,055	1,518	2,492	12,065	26,029
Apr.	13,896	9,081	1,595	2,242	12,918	26,814
May	15,214	10,031	1,745	2,342	14,118	29,332
June	14,140	9,142	1,530	1,941	12,613	26,753
July	14,785	9,364	1,564	2,064	12,992	27,777
Aug.	13,690	8,641	1,333	1,967	11,941	25,631
Sept.	12,852	9,172	1,494	2,034	12,700	25,552
Oct.	10,634	10,000	1,626	1,999	13,625	24,259
Nov.	9,284	9,180	1,798	2,300	13,278	22,562

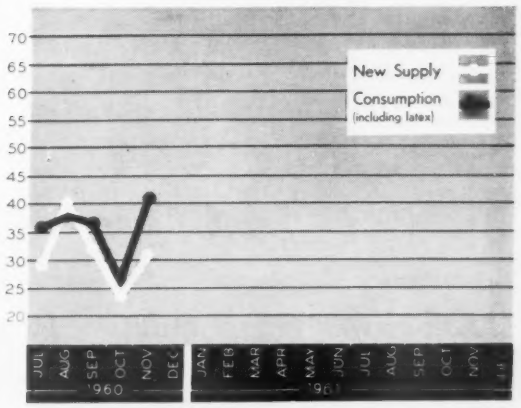
Source: U. S. Department of Commerce.
Note: (1) GR-S and Neoprene consumption estimated through 1950.

STATISTICS at a glance

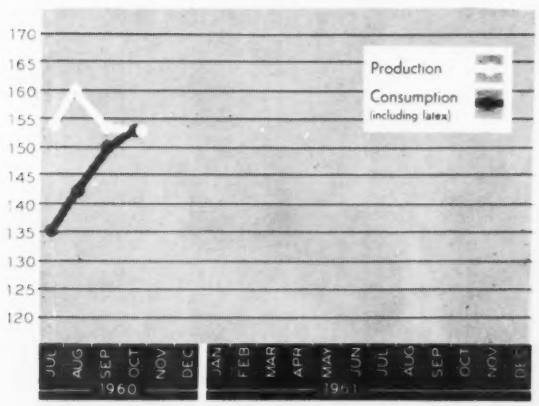
NATURAL RUBBER—WORLD
(thousands of long tons)



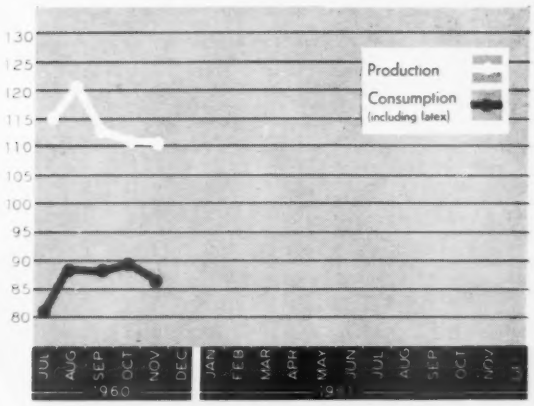
NATURAL RUBBER—UNITED STATES
(thousands of long tons)



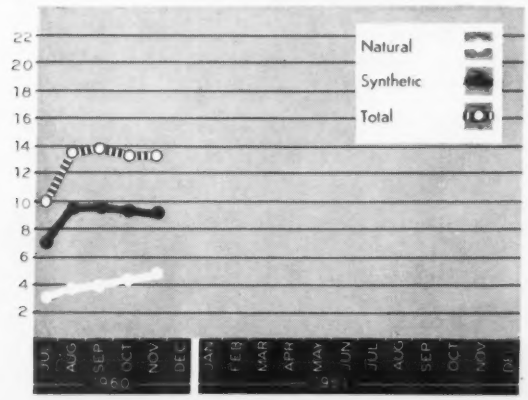
SYNTHETIC RUBBER—WORLD
(thousands of long tons)



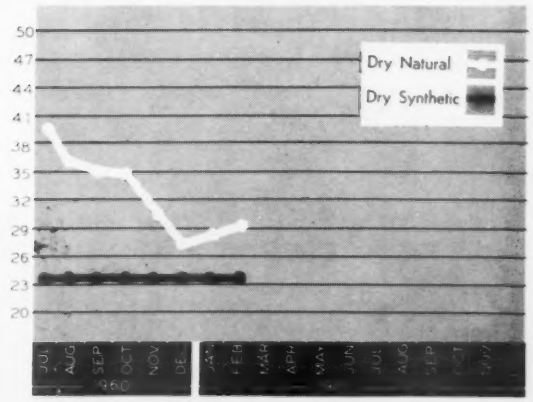
SYNTHETIC RUBBER—UNITED STATES
(thousands of long tons)



LATEX CONSUMPTION—UNITED STATES
(thousands of long tons)



PRICES—NATURAL AND SYNTHETIC
(cents per pound)



Automotive Pneumatic Casings

(Thousands of Units)

	Shipments					
	Original Equipment	Replacement	Export	Total	Production	Inventory End of Period
1954 (total)	**33,333**	**55,155**	**1,753**	**90,241**	**89,141**	**14,762**
Passenger Car	**29,741**	**47,044**	**928**	**77,713**	**76,794**	**12,217**
Truck and Bus	**3,591**	**8,111**	**826**	**12,528**	**12,347**	**2,545**
1955 (total)	**47,374**	**59,246**	**1,879**	**108,499**	**112,178**	**18,778**
Passenger Car	**42,574**	**50,189**	**966**	**93,730**	**97,223**	**15,963**
Truck and Bus	**4,800**	**9,057**	**912**	**14,769**	**14,955**	**2,815**
1956 (total)	**35,422**	**62,146**	**1,757**	**99,325**	**100,406**	**79,872**
Passenger Car	30,873	53,252	875	85,000	85,546	16,494
Truck and Bus	4,548	8,894	883	14,325	14,859	3,378
1957 (total)	**36,765**	**65,150**	**1,733**	**103,649**	**106,940**	**250,536**
Passenger Car	**32,725**	**56,603**	**889**	**90,217**	**93,542**	**210,146**
Truck and Bus	**4,053**	**8,546**	**846**	**13,432**	**13,398**	**40,384**
1958 (total)	**26,783**	**70,797**	**1,348**	**98,928**	**96,563**	**20,939**
Passenger Car	23,408	61,570	717	85,696	83,636	17,778
Truck and Bus	3,375	9,226	631	13,232	12,927	3,161
1959 (total)	**34,163**	**76,812**	**1,430**	**112,405**	**117,875**	**26,933**
Passenger Car	29,746	66,797	786	97,329	102,637	23,578
Truck and Bus	4,417	10,015	644	15,076	15,238	3,355
1960 (total)	40,205	77,785	1,722	119,712	119,844	27,540
Passenger Car	36,320	68,535	943	105,799	105,361	23,583
Truck and Bus	3,885	9,250	777	13,912	14,482	3,957
1960:						
Jan. (total)	4,333	6,823	156	11,322	10,325	25,943
Passenger Car	3,912	6,006	111	10,030	9,011	22,567
Truck and Bus	421	826	45	1,292	1,315	3,376
Feb. (total)	3,996	6,047	136	10,179	10,772	26,473
Passenger Car	3,569	5,257	78	8,904	9,371	22,972
Truck and Bus	421	789	59	1,275	1,401	3,502
Mar. (total)	3,753	5,827	157	9,737	11,115	27,921
Passenger Car	3,333	5,156	90	8,578	9,679	24,144
Truck and Bus	421	671	67	1,158	1,436	3,777
Apr. (total)	3,584	7,348	182	11,114	10,517	27,401
Passenger Car	3,200	6,558	114	9,872	9,165	23,512
Truck and Bus	385	790	68	1,243	1,352	3,889
May (total)	3,724	7,306	157	11,188	10,779	26,967
Passenger Car	3,361	6,542	78	9,981	9,458	22,985
Truck and Bus	363	764	80	1,207	1,321	3,982
June (total)	3,449	7,892	174	11,515	10,892	26,359
Passenger Car	3,098	7,105	94	10,297	9,559	22,271
Truck and Bus	352	787	80	1,218	1,332	4,088
July (total)	2,735	7,228	150	10,113	9,788	26,108
Passenger Car	2,456	6,377	82	8,915	8,680	22,097
Truck and Bus	279	851	68	1,197	1,108	4,011
Aug. (total)	1,578	7,213	151	8,941	9,147	26,298
Passenger Car	1,359	6,389	76	7,824	8,061	22,326
Truck and Bus	219	823	75	1,117	1,085	3,972
Sept. (total)	2,950	6,560	120	9,630	9,184	25,893
Passenger Car	2,676	5,749	59	8,484	8,158	22,037
Truck and Bus	273	811	61	1,146	1,026	3,856
Oct. (total)	3,589	6,304	121	10,014	9,530	25,499
Passenger Car	3,342	5,366	53	8,760	8,461	21,816
Truck and Bus	247	938	62	1,254	1,069	3,683
Nov. (total)	3,425	4,772	105	8,303	9,044	26,290
Passenger Car	3,171	4,123	55	7,348	7,979	22,493
Truck and Bus	255	649	51	955	1,066	3,797
Dec. (total)	3,087	4,464	112	7,663	8,804	27,541
Passenger Car	2,844	3,912	55	6,812	7,809	23,583
Truck and Bus	243	552	56	851	995	3,957

Source: The Rubber Manufacturers Association, Inc.

Automobile Production in U. S.

(Civilian Production Only)

Year	Passenger Cars	Trucks	Total	Year	Passenger Cars	Trucks	Total
1941	3,744,500	875,381	4,619,681	1951	5,337,729	1,420,432	6,758,161
1942	220,814	133,083	353,897	1952	4,320,794	1,212,790	5,533,584
1943	0	4,501	4,501	1953	6,121,787	1,202,196	7,323,983
1944	0	124,819	124,819	1954	5,558,897	1,038,045	6,596,942
1945	83,792	313,643	397,435	1955	7,920,186	1,245,018	9,165,204
1946	2,148,699	930,760	3,079,429	1956	5,816,109	1,100,417	6,916,525
1947	3,558,178	1,220,634	4,778,812	1957	6,113,344	1,097,006	7,210,350
1948	3,909,270	1,363,856	5,132,090	1958	4,257,812	874,278	5,132,090
1949	5,108,841	1,123,736	6,232,577	1959	5,591,243	1,134,858	6,726,101
1950	6,665,836	1,332,263	7,998,099	1960	6,674,796	1,193,769	7,860,565
1959:							
Jan.	539,451	96,044	635,495	July	548,524	114,687	663,211
Feb.	476,977	99,973	576,950	Aug.	255,831	60,147	315,978
Mar.	575,012	111,355	686,367	Sept.	229,410	79,573	308,983
Apr.	585,789	116,910	702,699	Oct.	537,159	94,993	632,152
May	543,001	114,995	659,996	Nov.	267,829	53,968	321,797
June	554,878	119,544	674,422	Dec.	475,382	72,669	548,051
1960:							
Jan.	676,712	115,268	791,980	July	421,355	79,444	500,799
Feb.	656,579	125,938	782,517	Aug.	324,020	65,948	389,968
Mar.	659,730	131,169	780,899	Sept.	386,694	77,038	463,732
Apr.	588,046	114,590	702,636	Oct.	627,678	75,034	702,712
May	607,191	118,023	727,214	Nov.	600,495	86,957	687,452
June	605,582	111,420	717,002	Dec.	520,714	92,940	613,654

Source: Automobile Manufacturers Association.
Note: Figures are based on factory sales. Revisions are made from time to time in these figures and the latest issue should be consulted for accuracy.

Automotive Inner Tubes

(Thousands of Units)

	Shipments					
Year	Original Equipment	Replacement	Export	Total	Production	Inventory End of Period
1948	**26,833**	**40,548**	**1,119**	**68,499**	**70,033**	**9,641**
1949	**31,521**	**31,450**	**887**	**63,858**	**65,114**	**10,657**
1950	**41,240**	**42,671**	**811**	**84,723**	**80,179**	..
1951	**32,151**	**32,284**	**1,071**	**65,507**	**67,249**	**10,094**
1952	**29,451**	**32,985**	**1,014**	**63,449**	**65,073**	**12,036**
1953	**37,957**	**36,072**	**878**	**74,907**	**74,425**	**11,874**
1954	**25,071**	**35,576**	**945**	**61,593**	**48,279**	**9,519**
1955	**5,001**	**33,387**	**1,001**	**39,389**	**35,900**	**6,833**
1956	**3,100**	**32,358**	**1,040**	**36,498**	**34,405**	**6,109**
1957	**3,046**	**35,687**	**1,076**	**39,806**	**39,774**	**80,077**
1958	**2,678**	**37,872**	**870**	**41,420**	**41,266**	**8,602**
1959	**3,624**	**41,522**	**891**	**46,037**	**46,059**	**10,536**
1960	**3,349**	**36,324**	**1,120**	**40,793**	**40,980**	**11,034**
1960:						
Jan.	365	4,964	62	5,391	3,899	8,924
Feb.	370	3,554	87	4,011	4,043	9,002
Mar.	365	2,807	111	3,282	4,241	10,113
Apr.	330	2,862	114	3,306	3,628	10,495
May	307	2,932	91	3,330	3,611	10,852
June	295	3,154	98	3,547	3,444	10,700
July	242	3,103	94	3,440	3,261	10,627
Aug.	169	3,056	83	3,308	3,017	10,254
Sept.	232	2,563	100	2,894	3,024	10,446
Oct.	222	2,666	111	3,000	3,067	10,589
Nov.	229	2,354	74	2,657	2,921	10,859
Dec.	224	2,499	95	2,818	2,913	11,034

Source: The Rubber Manufacturers Association, Inc.

Vinyl and Vinyl Copolymer Resins—Sales

(Thousands of Pounds—Resin Content)

	Polyvinyl Chloride and Copolymer Resins							All Other Vinyl Resins		
	Film	Sheeting	Molding & Extrusion	Textile & Paper Treating	Flooring	Protective Coatings	All Other Uses	Adhesives	All Other Uses	Grand Total
1956	**78,063**	**55,598**	**206,726**	**62,931**	**65,384**	**28,522**	**71,859**	**36,565**	**115,151**	**720,799**
1957	**90,543**	**56,344**	**216,517**	**66,392**	**81,357**	**31,519**	**50,637**	**41,665**	**113,396**	**748,370**
1958	**72,404**	**67,594**	**214,701**	**63,050**	**113,583**	**28,913**	**68,307**	**52,904**	**117,752**	**801,208**
1959	**85,136**	**125,639**	**304,711**	**64,703**	**151,840**	**31,371**	**94,418**	**57,599**	**159,528**	**1,074,945**
1960	98,917	126,881	284,520	62,452	161,106	38,577	112,415	59,105	151,857	1,105,380
1960:										
Apr.	8,272	10,816	22,835	5,157	12,811	3,431	8,482	4,797	12,644	89,245
May	7,610	11,623	24,221	5,466	13,103	3,449	8,194	4,891	12,555	91,112
June	9,036	12,074	23,683	5,332	12,489	3,846	11,534	5,265	11,712	94,971
July	5,861	9,805	18,414	3,956	10,107	3,485	9,155	4,116	11,773	76,672
Aug.	9,005	9,971	26,087	7,021	13,739	3,874	12,383	5,539	12,106	99,725
Sept.	7,662	11,095	25,116	5,571	15,723	3,922	9,510	4,884	13,378	96,861
Oct.	9,176	11,109	25,490	5,175	15,194	2,887	11,304	5,087	12,391	97,813
Nov.	7,351	10,830	25,459	4,615	14,004	2,873	9,784	4,751	12,845	92,062
Dec.	7,948	8,638	22,065	5,001	12,507	2,322	6,823	4,264	11,519	81,087

Source: Chemical Division, U. S. Tariff Commission.

Rubber Industry Employment Earnings and Hours

All Rubber Products

Mo.	1959 Production Workers (thousands)	1959 Average Weekly Earnings	1959 Average Weekly Hours	1959 Average Hourly Earnings	1960 Production Workers (thousands)	1960 Average Weekly Earnings	1960 Average Weekly Hours	1960 Average Hourly Earnings
Jan.	199.1	$100.28	41.1	$2.45	208.0	$102.16	40.7	$2.51
Feb.	198.8	101.09	41.6	2.44	208.6	100.00	40.0	2.50
Mar.	201.5	103.74	42.0	2.43	207.5	97.71	39.4	2.48
Apr.	176.0	101.57	41.8	2.47	200.7	94.60	38.3	2.47
May	171.8	101.46	42.1	2.43	197.6	100.04	39.7	2.52
June	196.1	98.74	40.3	2.45	197.9	102.72	40.6	2.53
July	203.4	107.10	42.5	2.52	191.7	103.53	40.6	2.55
Aug.	203.8	105.53	42.3	2.49	196.1	100.15	39.9	2.51
Sept.	212.4	102.01	41.3	2.47	197.8	98.28	39.0	2.52
Oct.	212.3	101.18	40.8	2.48	198.1	100.69	39.8	2.53
Nov.	209.1	97.66	39.7	2.46	195.6	.....	...	...
Dec.	208.0	101.59	40.8	2.49	....	.....	...	...
Tires and Tubes								
Jan.	76.9	117.55	41.1	2.87	77.9	119.80	40.2	2.98
Feb.	76.2	118.98	41.6	2.86	77.4	117.71	39.5	2.98
Mar.	77.9	122.96	42.4	2.86	78.8	113.68	38.8	2.93
Apr.	66.0	123.98	42.9	2.90	78.1	107.38	36.9	2.91
May	52.2	126.13	42.9	2.89	77.0	117.51	39.7	2.96
June	70.7	108.93	36.8	2.96	76.6	121.39	40.6	2.99
July	79.7	128.74	43.2	2.98	75.9	123.71	41.1	3.01
Aug.	78.4	127.74	43.3	2.95	75.7	114.66	39.0	2.94
Sept.	80.5	117.56	40.4	2.91	74.5	112.40	38.1	2.95
Oct.	79.7	117.49	40.1	2.93	74.1	115.53	38.9	2.97
Nov.	79.0	112.62	38.7	2.91	....	.....	...	...
Dec.	78.1	118.59	40.5	2.94	....	.....	...	...
Rubber Footwear								
Jan.	17.1	78.20	39.9	1.96	19.0	79.40	39.5	2.01
Feb.	17.1	80.59	40.7	1.96	19.0	77.21	38.8	1.99
Mar.	17.4	79.79	40.3	1.98	18.9	78.61	39.5	1.99
Apr.	12.9	73.05	39.7	1.98	18.5	77.01	38.7	1.99
May	17.7	79.58	40.6	1.84	18.1	81.40	40.1	2.03
June	18.2	81.58	41.2	1.98	18.2	82.82	40.6	2.04
July	18.3	78.60	40.1	1.96	17.6	82.21	40.3	2.04
Aug.	18.4	79.17	40.6	1.95	18.2	81.40	40.1	2.03
Sept.	19.0	79.18	40.4	1.96	18.5	79.18	39.2	2.02
Oct.	19.1	79.40	39.9	1.99	18.5	82.59	39.9	2.07
Nov.	19.6	79.80	39.9	2.00	....	.....	...	...
Dec.	19.4	80.79	39.9	2.04	....	.....	...	...
All Other Rubber Products								
Jan.	105.1	91.27	41.3	2.21	111.1	93.52	41.2	2.27
Feb.	105.5	91.96	41.8	2.21	112.2	91.76	40.6	2.26
Mar.	106.2	93.02	41.9	2.20	109.8	89.78	39.9	2.25
Apr.	97.1	90.03	41.3	2.22	104.1	88.43	39.3	2.25
May	101.9	92.18	41.9	2.18	102.5	90.12	39.7	2.27
June	107.2	94.98	42.4	2.24	103.1	92.34	40.5	2.28
July	105.4	95.40	42.4	2.25	98.2	91.66	40.2	2.28
Aug.	107.0	93.21	41.8	2.23	102.2	92.75	40.5	2.29
Sept.	112.9	94.73	42.1	2.25	104.8	92.10	39.7	2.32
Oct.	113.5	93.38	41.5	2.25	105.5	93.73	40.0	2.32
Nov.	110.5	89.87	40.3	2.23	....	.....	...	...
Dec.	110.5	92.93	41.2	2.25	....	.....	...	...

Source: U. S. Department of Labor.

Note: Data are based upon reports from cooperating establishments covering both full and part-time employees who work during, or received pay for, any part of the pay period ending nearest the 15th of the month. These employment series have been adjusted to first quarter 1954 benchmark levels indicated by data from government social insurance programs. Hours and earnings data pertain only to production and related workers.

Spot Closing Cotton Prices

(Middling Upland Grade—New York Market—in Cents)

Average Monthly Price Per Pound

	1954	1955	1956	1957	1958	1959	1960	1961
Jan.	34.16	35.07	35.24	34.82	36.31	35.67	33.09	32.25
Feb.	35.00	35.04	36.26	34.82	35.83	35.69	33.20	32.35
Mar.	35.23	34.33	36.70	35.35	36.05	35.71	33.54	....
Apr.	35.22	34.23	36.43	35.43	36.00	36.05	34.10	....
May	35.34	34.80	36.65	35.40	36.27	36.24	34.15	....
June	35.17	34.83	36.67	35.45	36.33	36.05	34.22	....
July	35.37	34.61	35.43	35.49	36.51	34.67	33.96	....
Aug.	35.19	34.53	34.31	35.15	36.36	33.17	32.59	....
Sept.	35.46	33.85	34.35	34.74	36.00	32.99	32.39	....
Oct.	35.24	33.93	34.45	35.09	36.23	32.77	32.21	....
Nov.	34.80	34.87	34.56	36.06	36.24	32.79	32.27	....
Dec.	35.03	34.95	34.56	36.50	35.75	33.02	31.60	....
Average for Year	35.10	34.59	35.50	35.36	36.16	34.57	33.10	....

Note: The Government established a ceiling of 45.76c for spot cotton on March 3, 1951. (a) Trading suspended during February.

Production Index for the Rubber Industry

(1957 = 100)

(Based on man-hours)

	1958	1959	1960		1958	1959	1960
Jan.	116	108	118	July	125	128	117
Feb.	114	113	117	Aug.	131	120	115
Mar.	116	112	115	Sept.	136	120	111
Apr.	112	104	115	Oct.	140	116	110
May	113	105	117	Nov.	131	120	110
June	125	117	122	Dec.	136	120	...

Sales by the Rubber Industry

(in Millions of Dollars*)

	1958	1959	1960		1958	1959	1960
Jan.	448	508	530	July	478	519	480
Feb.	413	490	570	Aug.	438	492	489
Mar.	396	506	510	Sept.	464	544	510
Apr.	429	543	530	Oct.	493	555	490
May	428	524	550	Nov.	472	482	500
June	445	520	520	Dec.	518	500	480

Rubber Manufacturers' Inventories

(in Millions of Dollars*)

	1958	1959	1960		1958	1959	1960
Jan.	1,100	998	1,140	July	980	1,075	1,230
Feb.	1,087	1,022	1,140	Aug.	1,024	1,113	1,240
Mar.	1,069	1,030	1,160	Sept.	1,024	1,115	1,200
Apr.	1,047	1,015	1,190	Oct.	1,022	1,115	1,160
May	1,020	995	1,180	Nov.	1,018	1,120	1,140
June	986	1,013	1,200	Dec.	994	1,140	1,160

Source: U. S. Department of Commerce.
Notes: * Adjusted for seasonal variation.

No. 1 R.S.S.—Annual Average Prices

(New York Market—Cents per Pound)

Year	High	Low	Avg.	Year	High	Low	Avg.
1919	57	38½	48.70	1940	24	18¼	20.10
1920	56½	16	36.30	1941	24⅞	19⅛	22.40
1921	21¾	11½	16.36	1942	22½	22½	22.50
1922	28⅜	13⅝	17.50	1943	22½	22½	22.50
1923	37⅛	24¾	29.45	1944	22½	22½	22.50
1924	40⅝	17⅝	26.20	1945	22½	22½	22.50
1925	121	34⅜	72.46	1946	22½	22½	22.50
1926	88½	36¾	48.50	1947	25	14	20.00
1927	41¾	33	37.72	1948	25	18	21.99
1928	41¾	17	22.48	1949	19¾	15⅞	17.57
1929	26⅞	15½	20.55	1950	86	18	41.10
1930	16½	7½	11.98	1951	76	52	(a)
1931	8⅝	4¼	6.17	1952*	33	26½	29.15
1932	4¾	2½	3.49	1953	31⅞	19⅞	24.21
1933	9⅞	2⅞	5.96	1954	34½	19½	23.61
1934	15⅞	8¾	12.92	1955	52	29⅜	39.16
1935	13¾	10½	12.37	1956	45	26½	34.24
1936	23	13½	16.41	1957	37⅛	26⅝	31.13
1937	26⅞	14	19.39	1958	32⅝	24⅝	28.13
1938	17 9/16	10¼	14.64	1959	49	29¾	36.56
1939	24	14 11/16	17.57	1960	47½	28⅜	38.09

Note: Price was fixed by Government on August 6, 1941, at 22½c a pound for non-war uses. Free trading was resumed May 1, 1947. (a) Free trading suspended March 31, 1951. GSA selling price ranged between 52 and 66c during balance of year. * Free trading was resumed on July 1, 1952; figures represent only July through December, 1952.

No. 1 R.S.S.—Monthly Average Prices

(New York Market—Cents per pound)

	1954	1955	1956	1957	1958	1959	1960	1961
Jan.	20.22	33.92	41.70	33.32	27.15	30.34	41.18	28.77
Feb.	19.98	34.90	33.68	30.43	26.32	30.26	39.33	29.00
Mar.	20.16	31.08	33.68	31.76	26.65	31.62	40.74	....
Apr.	22.06	31.75	31.75	32.23	26.44	33.72	40.35	....
May	21.96	31.35	29.61	32.12	25.51	36.48	43.62	....
June	23.01	34.74	30.54	32.80	26.20	34.31	45.70	....
July	24.12	40.84	33.91	32.88	27.70	35.19	40.90	....
Aug.	23.00	48.85	35.69	32.13	28.72	38.43	36.69	....
Sept.	23.00	48.27	32.64	29.94	29.49	40.22	35.04	....
Oct.	26.57	43.81	32.68	29.24	31.06	41.50	34.06	....
Nov.	28.07	44.95	35.18	27.47	32.10	45.16	30.63	....
Dec.	29.88	48.40	37.01	29.25	30.28	41.46	28.81	....
Average for Year	23.61	39.16	34.24	31.13	28.13	36.56	38.09	....

Various Compounding Materials Consumed by the Rubber Industry

Material	1952	1953	1954	1955	1956	1957	1958
Antimony, Primary							
Short tons	66c	20c	49c	78	156	284	265
% of total	.004	.001	.004	.006	.010	.024	.022
Asphalt: [a]							
Short tons	33,288	.....	.....	.....	.....	.....	.....
% of total	0.4	.....	.....	.....	.....	.....	.....
Barite (Barytes):							
Short tons	18,000	21,000	20,000	25,104	22,101	21,782	18,387
% of total	2.0	2.0	2.0	2.0	2.0	1.0	2.0
Short tons	537,273	566,797	511,831	643,430	622,325	635,781	625,469
Carbon Black:							
% of total	93.1	94.4	93.5	93.5	95.5	45.5	95.3
Clay, Kaolin:							
Short tons	240,982	241,052	247,431	257,223	268,157	301,185	282,493
% of total	13.2	12.8	13.2	11.9	12.0	14.0	17.1
Clay, Fire & Stoneware:							
Short tons	9,322	18,475	8,781	2,928	.....	.....	.....
% of total	0.1	.2	.1	.2	.....	.....	.....
Lime:							
Short tons	2,000	1,631	1,555	1,465	2,487	2,799	2,533
% of total	(d)	(d)	(d)	(d)	(d)	(d)	(d)
Litharge:							
Short tons	2,109	2,230	1,768	1,947	2,266	1,298	1,247
% of total	1.1	1.4	1.3	1.3	1.7	1.7	1.4
Lithopone:							
Short tons	1,523	1,723	1,701	2,163	2,000[e]	.....	.....
% of total	2.5	3.3	3.9	5.0	5.0	.....	.....
Mica, Ground:							
Short tons	5,126	5,668	5,021	7,339	7,021	8,579	9,622
% of total	7.0	7.8	6.3	6.9	8.0	9.0	9.9
Sulfur:							
Short tons	84,000	89,600	84,000	89,600	89,600	89,600[e]	.....
% of total	1.4	1.4	1.3	1.2	1.1	1.1	.....
Talc: [b]							
Short tons	64,476	61,408	58,139	38,309	30,253	28,532	36,889
% of total	10.9	10.0	9.7	5.4	5.0	6.0	6.5
Zinc Oxide:							
Short tons	72,774	78,439	71,058	86,677	80,459	81,745	68,176
% of total	51.2	52.7	50.7	51.5	51.9	54.0	46.5

Source: U. S. Bureau of Mines.
Notes: (a) Solid and semi-solid products of less than 200 penetration. (b) Includes prophyllite and ground soapstone. (c) Does not include precipitated antimony sulfide as in previous years. (d) Negligible. (e) Estimated.

Reclaimed Rubber
(Including Natural and Synthetic)
(All Quantities in Long Tons)

Year	New Supply	Consumption Tons	Consumption % to Crude [a]	Exports	Stocks On Hand at End of Period
1941	274,202	251,231	32.2	13,851	41,750
1942	286,007 [b]	254,620	64.6	30,405	42,532
1943	304,058 [c]	291,082	59.6	15,678	46,201
1944	260,631 [d]	251,083	35.3	11,800	43,832
1945	243,309	241,036	30.2	13,413	28,155
1946	295,012	275,410	26.5	14,461	33,000
1947	291,395	288,395	24.8	14,556	35,943
1948	266,861	261,113	24.4	11,428	32,030
1949	224,029	226,679	22.5	10,637	28,263
1950	314,008	303,733	24.1	11,740	35,708
1951	366,700	346,121	26.6	14,722	45,082
1952	274,981	280,002	22.2	11,180	30,664
1953	298,336	285,050	21.3	11,597	32,319
1954	258,101	249,049	20.2	10,232	30,746
1955	326,649	312,781	20.4	13,988	31,498
1956	287,220	270,547	18.8	13,832	34,969
1957	271,647	267,352	18.2	13,021	29,323
1958	259,809	248,156	18.2	11,362	29,063
1959	303,479	286,410	20.0	11,757	27,738
1959:					
Nov.	22,525	20,217	16.1	909	28,526
Dec.	23,720	22,962	17.4	1,055	27,738
1960:					
Jan.	26,532	26,540	18.9	1,106	29,031
Feb.	27,085	25,944	18.6	1,258	28,653
Mar.	29,114	26,625	18.4	1,542	29,719
Apr.	26,221	24,210	18.2	1,248	30,916
May	25,676	23,763	17.8	1,167	32,611
June	25,516	24,677	17.8	1,164	31,699
July	21,512	19,249	16.8	1,384	33,624
Aug.	23,540	21,452	16.3	951	33,979
Sept.	22,306	22,101	17.8	1,028	33,949
Oct.	23,546	23,269	18.5	804	33,519
Nov.	22,023	21,014	17.2	1,167	33,783

Source: U. S. Department of Commerce.
Notes: (1) These figures are revised from time to time and the latest available issue should be consulted for the most accurate data. (a) Includes natural and synthetic rubber. (b) Includes 893 tons of imports. (c) Includes 67 tons of imports. (d) Includes 21 tons of imports.

Cotton, Rayon and Nylon Tire Fabrics
(In Thousands of Pounds)

	Production: Rayon Tire Cord Net Woven	Production: Rayon Tire Cord Woven	Production: Cotton and Nylon Cord & Fabric [a]	Production: Chafer Fabrics (all fibers)	Production: Total Tire Cord and Fabric	Stocks [b]: Cotton and Nylon Cord & Fabric	Stocks [b]: Rayon Cord and Fabric
1958:							
Jan.-Mar.	8,372	56,522	25,647	7,367	92,924	11,255	33,913
Apr.-June	.....	.....	30,745	6,020	80,533	11,274	26,327
July-Sept.	.....	.....	31,371	6,467	91,984	11,229	26,428
Oct.-Dec.	.....	.....	34,858	8,466	107,532	12,251	25,936
Total	8,372	56,522	122,621	28,320	372,973	46,009	112,604
1959:							
Jan.-Mar.	77,307	77,307	41,565	9,163	122,661	14,025	22,093
Apr.-June	76,265	76,265	37,102	7,699	116,965	16,811	31,094
July-Sept.	76,671	76,671	39,863	8,318	119,748	14,040	35,152
Oct.-Dec.	.....	.....	.....	.....	.....	.....	.....
Total	.....	.....	.....	.....	.....	.....	.....

Source: Bureau of the Census, U. S. Department of Commerce.
Notes: (a) Combined to avoid disclosing figures for individual companies. (b) At end of period.

Gasoline Consumption
(In Thousands of Barrels of 42 Gallons)

	1954	1955	1956	1957	1958	1959	1960
Jan.	89,634	96,397	100,642	109,295	107,281	114,720	111,311
Feb.	86,206	88,464	98,088	96,694	95,516	99,759	108,871
Mar.	101,549	105,684	112,412	113,166	108,914	118,995	120,497
Apr.	103,866	111,116	113,034	115,820	118,477	124,917	129,094
May	104,418	115,707	123,560	124,325	125,137	127,049	129,952
June	113,037	120,710	126,833	121,598	125,444	133,695	138,909
July	112,231	115,653	120,708	130,251	130,903	137,141	135,838
Aug.	110,223	121,816	125,847	128,808	129,925	132,875	138,371
Sept.	104,706	113,379	111,574	113,567	120,389	130,264	128,530
Oct.	105,607	112,558	119,204	119,334	125,097	120,858	126,242
Nov.	102,393	109,212	112,113	107,705	110,587	116,056	.....
Dec.	104,258	111,034	108,096	112,691	120,305	123,587	.....
Total	1,238,346	1,321,730	1,372,116	1,393,254	1,417,975	1,479,907	.....

Source: U. S. Bureau of Mines.

U. S. Gross Imports of Balata, Jelutong, Gutta-Percha, etc.
(All Quantities in Long Tons)

Year	Balata Tons	Balata Value	Jelutong Tons	Jelutong Value	Gutta-Percha & Other Guttas Tons	Gutta-Percha & Other Guttas Value
1951	2,452	1,975,271	1,569	2,608,359	383	430,539
1952	988	762,994	1,636	2,094,983	282	385,890
1953	1,619	866,248	1,027	1,166,837	235	303,116
1954	949	504,065	2,196	2,624,926	417	511,055
1955	1,022	967,369	1,679	1,731,621	284	318,115
1956	1,396	1,111,165	1,851	1,909,447	290	309,615
1957	1,037	670,821	1,680	1,942,067	230	270,487
1958	745	536,820	1,501	1,698,840	157	224,499
1959	1,512	1,350,843	1,296	1,608,986	268	311,178
1960:						
Jan.	144	219,497	84	100,515	47	57,798
Feb.	37	38,260	165	143,255	12	12,855
Mar.	47	42,000	37	44,269	4	15,197
Apr.	56	35,560	97	104,711	18	33,181
May	86	79,553	76	88,209	64	90,252
June	75	59,506	128	142,962	35	45,136
July	108	144,740	68	76,761	24	56,317
Aug.	207	213,484	88	99,726	35	55,090
Sept.	960	540,589	26	27,889	28	38,363
Oct.	420	659,078	39	41,574	11	13,230
Nov.	365	534,852	51	58,977	29	74,331

Source: U. S. Department of Commerce.

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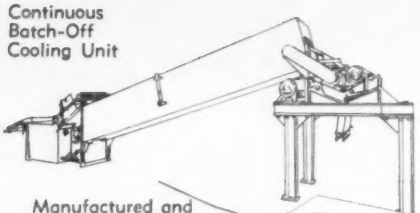

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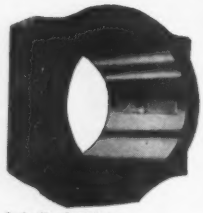

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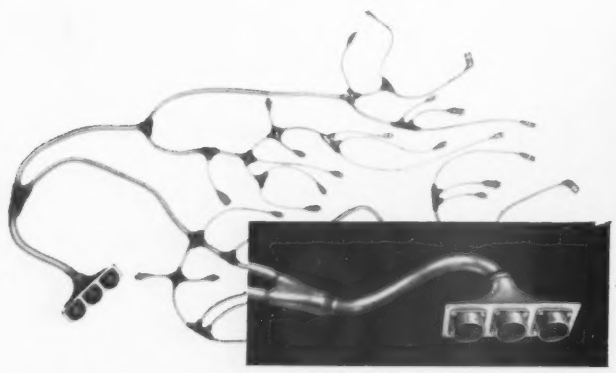

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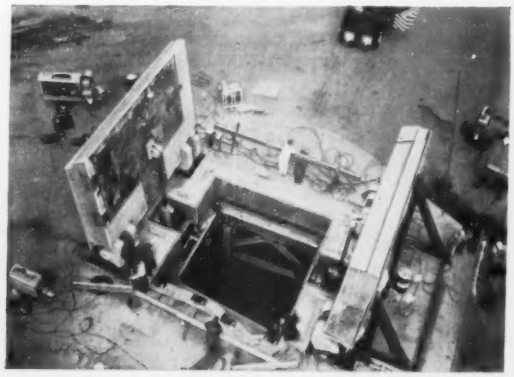

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